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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-31413*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 44

May 1974 77 p refs

(NASA-SP-7037(44)) Avail: NTIS HC $4.00 CSCL 01A

This special bibliography lists 249 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1974. Author

N74-31414*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL AND EXPERIMENTAL LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF AN ASPECT RATIO 0.25 SHARP-EDGE DELTA WING AT SUBSONIC, SUPERSONIC, AND HYPERSONIC SPEEDS

Charles H. Fox, Jr. and John E. Lamar Washington Aug. 1974 45 p refs

(NASA-TN-D-7651; L-9328) Avail: NTIS HC $3.25 CSCL 01A

The suction analogy concept of Polhamus for predicting vortex lift in conjunction with an appropriate potential-flow solution is called the present method. This method is applied to an aspect ratio 0.25 sharp-edge delta wing from a Mach number of 0.143 to 10.4 in free air and at 0.074 in ground effect, and also to an aspect ratio 0.35 triangular crosssectional body at a Mach number of 6.9. The models had subsonic leading edges at the test Mach numbers. Vortex-flow effects could be neither confirmed nor denied to exist at high speeds because of the lack of flow visualization above a Mach number of 0.143. The data, however, could be better predicted by including a vortex-flow effect, although not always to the extent predicted from the present method because of the presence of actual and hypothesized unmodeled flow situations. The method of Nenni and Tung (NASA CR-1860) tended to confirm the existence of vortex flow at hypersonic speeds. The hypersonic-tangent-cone method predicted best the delta-wing results over the test angle-of-attack range and hypersonic Mach number range and did equally as well as the present method for the triangular body. Author

N74-31415*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYTICAL STUDY OF THE EFFECTS OF JETS LOCATED MORE THAN ONE JET DIAMETER ABOVE A WING AT SUBSONIC SPEEDS

Lawrence E. Putnam Washington Aug. 1974 41 p refs

(NASA-TN-D-7754; L-9683) Avail: NTIS HC $3.25 CSCL 01A

A procedure has been developed for calculating the effects of blowing two jets over a swept tapered wing at low subsonic speeds. The algorithm used is based on a vortex-lattice representation of the wing lifting surface and a line sink-source distribution to simulate the effects of the jet exhaust on the wing lift and drag. The method is limited to those cases in which the jet exhaust does not intersect or wash the wing. The predictions of this relatively simple procedure are in remarkably good agreement with experimentally measured interference lift and interference induced drag. Author

N74-31416*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF THREE SLENDER SHARP-EDGE 74 DEGREES SWEPT WINGS AT SUBSONIC, TRANSONIC, AND SUPERSONIC MACH NUMBERS

Edwin E. Davenport Washington Aug. 1974 77 p refs

(NASA-TN-D-7631; L-9433) Avail: NTIS HC $4.00 CSCL 01A

Slender sharp-edge wings having leading-edge sweep angles of 74 deg have been studied at Mach numbers from 0.60 to 2.80, at angles of attack from about minus 4 deg to 22 deg, and at angles of sideslip from 0 deg to 5 deg. The wings had delta, arrow, and diamond planforms. The experimental tests were made in the Langley 8-foot transonic pressure tunnel and the Langley Unitary Plan wind tunnel test section number 1. The theoretical predictions were made using the theories of NASA TN D-3767 and NASA TN D-6243. The results of the study indicated that the lift and drag characteristics as affected by planform and Mach number could be reasonably well predicted for the delta wing in the subsonic and transonic Mach number range. In the supersonic range, the delta and diamond wings were about equally good in the degree of agreement between experiment and theory. In making drag-due-to-lift predictions the vortex lift effects must be taken into account if reasonable results are to be obtained at moderate or high lift coefficients. Author

N74-31417*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TRANSONIC OFF-DESIGN DRAG AND PERFORMANCE OF AN AXISYMMETRIC INLET WITH 40 PERCENT INTERNAL CONTRACTION ON DESIGN

Richard R. Woollett, Edward T. Meleason, and David A. Choby Washington Aug. 1974 55 p refs

(NASA-TM-X-3042; E-7692) Avail: NTIS HC $3.75 CSCL 01A

An experimental investigation determined the drag and pressure performance of an axisymmetric supersonic inlet when operated in the transonic speed range. The inlet configuration was derived from a Mach 2.5 mixed compression inlet design with assumed variable geometry. At typical engine airflows the drag coefficient varied from 0.057 to 0.192 when the Mach number changed from 0.80 to 1.27. The presence of a wing simulator resulted in a sizable increase in total drag at Mach 1.2. This interference drag, which is roughly a 0.1 increase in drag coefficient, originates equally from an increase in both additive and cowl pressure drag. Author

N74-31418*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A HIGHLY LOADED TWO STAGE AXIAL-FLOW FAN
Robert S. Ruggeri and William A. Benser Washington Aug. 1974 200 p refs
(NASA-TM-X-3076; E-7851) Avail: NTIS HC $5.50 CSCL 01A

A two-stage axial-flow fan with a tip speed of 1450 ft/sec (442 m/sec) and an overall pressure ratio of 2.8 was designed, built, and tested. At design speed and pressure ratio, the measured flow matched the design value of 184.2 lbm/sec (83.55kg/sec). The adiabatic efficiency at the design operating point was 85.7 percent. The stall margin at design speed was 10 percent. A first-bending-mode flutter of the second-stage rotor blades was encountered near stall at speeds between 77 and 93 percent of design, and also at high pressure ratios at speeds above 105 percent of design. A 5 deg closed reset of the first-stage stator eliminated second-stage flutter for all but a narrow speed range near 90 percent of design. Author

N74-31419*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND SUPERSONIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF AN AFT TAIL FIGHTER CONFIGURATION WITH CAMBERED AND UNCAMBERED WINGS AND UNCAMBERED FUSELAGE
Samuel M. Dollyhigh Washington Aug. 1974 98 p refs
(NASA-TM-X-3078; L-9463) Avail: NTIS HC $4.00 CSCL 01C

An investigation has been made in the Mach number range from 0.20 to 2.16 to determine the longitudinal aerodynamic characteristics of a fighter airplane concept. The configuration concept employs a single fixed geometry inlet, a 50 deg leading-edge-angle clipped-arrow wing, a single large vertical tail, and low horizontal tails. The wing camber surface was optimized in drag due to lift and was designed to be self-trimming at Mach 1.40 and at a lift coefficient of 0.20. An uncambered or flat wing of the same planform and thickness ratio was also tested. However, for the present investigation, the fuselage was not cambered. Further tests should be made on a cambered fuselage version, which attempts to preserve the optimum wing loading on that part of the theoretical wing enclosed by the fuselage. Author

N74-31420*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF SEVERAL METHODS FOR PREDICTING SEPARATION IN A COMPRESSIBLE TURBULENT BOUNDARY LAYER
Philip M. Gerhart and Lawrence J. Bober Washington Aug. 1974 22 p refs
(NASA-TM-X-3102; E-7802) Avail: NTIS HC $3.00 CSCL 20D

Several methods for predicting the separation point for a compressible turbulent boundary layer were applied to the flow over a bump on a wind-tunnel wall. Measured pressure distributions were used as input. Two integral boundary-layer methods, three finite-difference boundary-layer methods, and three simple methods were applied at five free-stream Mach numbers ranging from 0.354 to 0.7325. Each of the boundary-layer methods failed to explicitly predict separation. However, by relaxing the theoretical separation criteria, several boundary-layer methods were made to yield reasonable separation predictions, but none of the methods accurately predicted the important boundary-layer parameters at separation. Only one of the simple methods consistently predicted separation with reasonable accuracy in a manner consistent with the theory. The other methods either indicated several possible separation locations or only sometimes predicted separation. Author

N74-31421*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS OF A WING-FUSELAGE CONFIGURATION AT ANGLES OF ATTACK UP TO 44 DEG
William P. Henderson and Jarrett K. Huffman Washington Sep. 1974 36 p refs
(NASA-TM-X-3087; L-9541) Avail: NTIS HC $3.25 CSCL 01B

An investigation has been conducted to determine the effects of configuration variables on the lateral-directional stability characteristics of a wing-fuselage configuration. The variables under study included variations in the location of a single center-line vertical tail and twin vertical tails, wing height, fuselage strakes, and horizontal tails. The study was conducted in the Langley high-speed 7-by 10-foot tunnel at a Mach number of 0.30, at angles of attack up to 44 deg and at sideslip angles of 0 deg and plus or minus 5 deg. Author

N74-31422# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
THREE-COMPONENT FORCE MEASUREMENTS OF A HEAT INSULATED AGARD HB-2 MODEL AT M EQUALS 4 AND M EQUALS 7 USING AN UNCOOLED BALANCE
Per Wesstroem and Stig Lundgren Feb. 1974 44 p refs
(FFA-Proj. AX-805:1)
(FFA-TN-AX-805) Avail: NTIS HC $5.25

A three component force measurement of an AGARD calibration model was conducted in a hypersonic wind tunnel. The speed ranges were Mach 4.0 to Mach 7.0 with angles of attack between minus 15 degrees and plus 15 degrees. The Reynolds number referred to the model diameter was 200,000 to 1.65 million. The model consisted of a stainless steel frame, covered by silicone rubber cladding. An uncooled conventional internal strain gage balance was used in the test. It was determined that force measurements on heat-insulated models by means of an uncooled balance are fully applicable. At the short testing times of approximately 10 seconds, no error occurred in the measured coefficients due to temperature drift. Author (ESRO)

N74-31423# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATION OF PRESSURE DISTRIBUTIONS FOR A WING AT HIGH SUBSONIC SPEED Final Report
Anders L. Gustavsson and Nada Agrell Feb. 1974 38 p refs
(Contracts FMV-F-INK 82223-72-004-07-001;
FMV-F-INK-82223-73-009-07-001; FFA-Proj. AU-1005:1)
(FFA-TN-AU-1005) Avail: NTIS HC $5.00

Pressure distributions were calculated for a swept and tapered wing and compared to experimental results. The original calculations were performed with the Woodward panel method for linearized potential flow, in which the Gothert rule is applied to obtain the effect of compressibility. As a first approach to get a more accurate treatment of the compressibility effects the semi-empirical rule developed at NLR has been applied. As a second approach and for comparison the semi-annalytical integral equation method of Norstrud has been used. It is based on the transonic small disturbance equations. Comparisons made at high subsonic Mach numbers show that both the Woodward panel method with the NLR compressibility rule applied and the method of Norstrud give very similar results. These results represent a significant improvement compared to the results obtained when applying the Gothert rule only. Author (ESRO)

N74-31424# European Space Research Organization, Paris (France).
INVESTIGATION OF THE COMBINED HEAT AND MASS TRANSFER ON A WETTED FLAT PLATE IN PARALLEL FLOW AND WITH TURBULENT BOUNDARY LAYER
Klaus-Juergen Schultz Jun. 1974 53 p refs Transl. into ENGLISH of Untersuch. des Gekoppelten Waerme- u. Stoffuebergangs an einer Feuchten Ebenen Platte bei Paralleler Anstroemung u. Turbulenter Grenzschicht, DLR-FB-73-11, DFVLR, 1973
(ESRO-TT-66; DLR-FB-73-11) Avail: NTIS HC $5.75; DFVLR, Porz, West Ger. 13.50 DM

Investigations were conducted of the combined heat and mass transfer during the evaporation of hydrocarbons from a porous flat plate, wetted on both sides, in parallel flow and with a turbulent boundary layer. The dependence of the mean heat and mass transfer rates upon the flow temperature, the flow velocity and the plate length is determined experimentally. The effect of a dry front area of the plate and the effect of a separation of the boundary layer on the front edge are also studied. The heat transfer rates on the wetted plate are compared

with those on a dry plate of similar design. In addition the heat and mass transfer rates are determined by a simplified calculation method which also includes the case of the laminar boundary layer. A comparison with the test results shows that this method is adequate for engineering calculations. Author (ESRO)

N74-31425# National Aerospace Lab., Amsterdam (Netherlands). Div. of Scientific Services.
CALCULATION OF UNSTEADY SUBSONIC AERODYNAMIC CHARACTERISTICS BY MEANS OF THE DOUBLET LATTICE METHOD
B. Bennekers and Th. E. Labrujere 14 Nov. 1972 49 p refs Sponsored by the Directorate of Materiel Air, RNLAF
(NLR-TR-73031-U) Avail: NTIS HC $5.50

A method is described for calculating the aerodynamic loading on nonplanar, infinitely thin, harmonically oscillating airfoils in subsonic flow as originally developed by Albano, Rodden, Giesing and Kalman. The generalized aerodynamic force coefficients are determined from the calculated pressure distributions. Because of the flexibility of the method, arising from the use of loading elements, it can be applied to a wide range of configurations including T-tails and biplanes. Author (ESRO)

N74-31426# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
HYPERSONIC VISCOUS-INVISID INTERACTION WITH VECTORED SURFACE MASS TRANSFER Scientific Report
G. R. Inger and T. F. Swean, Jr. Mar. 1974 120 p refs
(Grant AF-AFOSR-2173-72; AF Proj. 9781)
(AD-780600; VPI-Aero-012; AFOSR-74-0193TR) Avail: NTIS CSCL 01/1

A fundamental theoretical study of homogeneous vectored injection and suction in high speed flows with heat transfer and self-induced gradients is described, based on local similarity solutions of the laminar boundary layer equations. The results show the important effects of both injection velocity and vector angle on a variety of physical properties of practical interest such as velocity and temperature profiles, skin friction, heat transfer rate, displacement thickness and induced pressure field. In addition, the existence of a new set of solutions pertaining to upstream-vectored injection is established and investigated. Moreover, it is shown that the frictional heating associated with the tangential injection velocity component can significantly influence the heat transfer characteristics of high speed flows. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-31427*# Massachusetts Inst. of Tech., Cambridge.
FLIGHT CONTROL SYSTEMS RESEARCH Annual Report, 1 Sep. 1972 - 1 Sep. 1973
H. P. Whitaker, Y. Baram, and Y. Cheng Nov. 1973 50 p refs
(Grant NGL-22-009-548)
(NASA-CR-139595; RE-89) Avail: NTIS HC $5.50 CSCL 01C

Theoretical development is reported for the parameter optimization design technique needed for digital flight control system design. The results of an example case study applying the optimization technique for continuous systems to an F-8 aircraft feedback control system are presented. The concept of evolving the simplest system configuration that is capable of meeting a specified set of performance requirements is illustrated in this work. Author

N74-31428*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
[ROTOR BLADE-VORTEX INTERACTION] Final Report
Barnes W. McCormick [1973] 10 p
(Grant NGR-39-009-111)
(NASA-CR-139594) Avail: NTIS HC $4.00 CSCL 01B

The vortex lattice method has been extended to a single bladed rotor operating at high advance ratios and encountering a free vortex from a fixed wing upstream of the rotor. The predicted unsteady load distributions on the model rotor blade are generally in agreement with the experimental results. This method has also been extended to full scale rotor flight cases in which vortex induced loads near the tip of a rotor blade were indicated. Using conformal transformation methods an exact analysis of the effects of thickness on the lift due to a two dimensional wing vortex interaction is presented. Author

N74-31429# Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCES IN CONTROL SYSTEMS
May 1974 313 p refs In ENGLISH partly in FRENCH Conf. Presented at 17th Meeting of the Guidance and Control Panel of AGARD, Geilo, Norway, 24-26 Sep. 1973
(AGARD-CP-137) Avail: NTIS HC $18.75

The proceedings of a conference on control systems for aircraft control, engine control, and automatic pilots are presented. The subjects discussed include the following: (1) applied control theory, (2) control system performance optimization, (3) control system architecture and reliability, (4) application of advanced control systems, and (5) integrated flight control and operations. The characteristics of control systems for specific types of aircraft are analyzed. The development and application of fly by wire techniques are reported. The use of computers as an aid to flight control system design is explained. For individual titles, see N74-31430 through N74-31457.

N74-31430 Systems Technology, Inc., Hawthorne, Calif.
A HISTORICAL PERSPECTIVE FOR ADVANCES IN FLIGHT CONTROL SYSTEMS
Duane McRuer and Dunstan Graham *In* AGARD Advan. in Control Systems May 1974 7 p refs (For availability see N74-31429 21-02)

A brief history of the investigations into the nature of aircraft control and stability is presented. The activities of early investigators are examined and some of their accomplishments are cited. The historical eras are divided into the periods of 1890 to 1934, 1934 to 1947, and 1947 to the present. Examples of stability developments for specific aircraft are cited. Author

N74-31431 Office of the Assistant Chief of Staff (Air Force), Washington, D.C.
THE DIGITAL AIRPLANE AND OPTIMAL AIRCRAFT GUIDANCE
Allen D. Dayton *In* AGARD Advan. in Control Systems May 1974 14 p refs (For availability see N74-31429 21-02)

The use of optimal flight path guidance for aircraft in satisfying various military and civilian mission requirements is discussed. The concepts, systems, and algorithms which make optimal aircraft flight path guidance feasible are presented. The digital airplane which is based on a large digital computation capability, a digital data bus, sensors, and display systems is used as an example. The development of the methodology and algorithms for directing the aircraft is investigated. Author

N74-31432 Norges Tekniske Hoegskole, Trondheim.
SOME INTEGRITY PROBLEMS IN OPTIMAL CONTROL SYSTEMS
Ole A. Solheim *In* AGARD Advan. in Control Systems May 1974 10 p refs (For availability see N74-31429 21-02)

A multivariable feedback control system is defined as being of high integrity if it remains stable under failure conditions. Integrity problems encountered in optimal control systems are investigated. Two types of failure conditions are considered, namely actuator failure and sensor failure. As to the structure of the control system, a linear feedback law with feedback from all the state variables is considered. Systems with state estimators are also dealt with. The integrity problem is discussed based on the eigenvalues of the closed-loop system. Some design procedures are suggested. Finally, some numerical results are presented. Author

N74-31433 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
APPLICATION OF MODAL CONTROL THEORY TO THE DESIGN OF DIGITAL FLIGHT CONTROL SYSTEMS
Ulrich Hartmann *In* AGARD Advan. in Control Systems May 1974 21 p refs (For availability see N74-31429 21-02)

The design of digital flight control systems is substantially simplified by using modal design methods. The theory of modal design is based on a state space description of the control system. For a desired pole distribution of the control system this theory directly provides a gain matrix for the feedback of the state variables. Due to the fact that all state variables are not always available, the problem of estimating non-measurable state variables arises. For solving this problem the theory of observers can be used. It shows however that an observer is not in a position to provide without adaptation usable estimated values of the missing state variables for the complete flight range. For solving practical design problems a minimum order observer is therefore particularly suitable as it is generally easier to obtain programmable approximation laws for the small number of parameters of this observer. It was further attempted to circumvent the estimation problem by the following means: (1) simplification of the state equations to eliminate non-measurable state variables, (2) transformation of the state vector and, (3) appropriate selection of the desired pole distribution. It showed that in this way a prompt and direct design of discrete-time flight control systems is possible. Two examples are used to demonstrate the results of simulations and flight tests: The design of a pitch attitude control system and a roll/yaw control system for a STOL aircraft. Author

N74-31434* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER-AIDED DESIGN OF CONTROL SYSTEMS TO MEET MANY REQUIREMENTS
A. A. Schy, W. M. Adams, Jr., and K. G. Johnson *In* AGARD Advan. in Control Systems May 1974 7 p refs (For availability see N74-31429 21-02)
CSCL 01C

A method is described for using nonlinear programing in the computer-aided design of airplane control systems. It is assumed that the quality of such systems depends on many criteria. These criteria are included in the constraints vector (instead of attempting to combine them into a single scalar criterion, as is usually done), and the design proceeds through a sequence of nonlinear programing solutions in which the designer varies the specification of sets of requirements levels. The method is applied to design of a lateral stability augmentation system (SAS) for a fighter airplane, in which the requirements vector is chosen from the official handling qualities specifications. Results are shown for several simple SAS configurations designed to obtain desirable handling qualities over all design flight conditions with minimum feedback gains. The choice of the final design for each case is not unique but depends on the designer's decision as to which achievable set of requirements levels represents the best for that system. Results indicate that it may be possible to design constant parameter SAS which can satisfy the most stringent handling qualities requirements for fighter airplanes in all flight conditions. The role of the designer as a decision maker, interacting with the computer program, is discussed. Advantages of this type of designer-computer interaction are emphasized. Desirable extensions of the method are indicated. Author

N74-31435 Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A DESIGN PROCEDURE UTILIZING CROSSFEEDS FOR COUPLED MULTILOOP SYSTEMS
Paul S. Basile and R. E. Curry (MIT, Cambridge) *In* AGARD Advan. in Control Systems May 1974 10 p refs (For availability see N74-31429 21-02)

A frequency-domain design procedure for decoupling multi-input, multi-output systems is described; the frequency domain has the advantage of providing insight and ease of satisfying specifications that are difficult to meet with state-space methods. A design procedure for a two-input, two-output system without crossfeeds is presented first; crossfeeds are then introduced to alter the open loop dynamics, and the design procedure is applied to the modified plant. The constraints on the choice of crossfeeds are discussed. Extension to a two-input, three-output system is made when one of the outputs is dominated by another; guidelines for choosing the crossfeeds are given. This procedure is applied to design a lateral cruise control system for the space shuttle orbiter: exact decoupling with crossfeeds results in excellent closed loop response. Author

N74-31436 Norwegian Defence Research Establishment, Kjeller. Div. for Electronics.
CONSTRUCTION OF SUBOPTIMAL KALMAN FILTERS BY PATTERN SEARCH **c19**
Nils Christophersen and Truls Lange-Nielsen *In* AGARD Advan. in Control Systems May 1974 6 p refs (For availability see N74-31429 21-02)

A systematic method for the optimal determination of parameters in suboptimal Kalman filters is presented. Such simplified filters are frequently necessary in order to implement a Kalman filter on a small special purpose computer. In order to optimize the performance of these filters, a parameter optimization problem may be involved. The method of solution is a modified version of Rosenbrock's pattern search. This is a direct search, permitting a very wide class of performance measures not necessarily analytical in nature. The example given is the determination of a suboptimal filter for a hybrid marine navigation system with thirty state variables. Author

N74-31437 Singer Co., Little Falls, N.J. Kearfott Div.
USE OF ADVANCED CONTROL THEORY AS A DESIGN TOOL FOR VEHICLE GUIDANCE AND CONTROL
P. M. Brodie *In* AGARD Advan. in Control Systems May 1974 10 p (For availability see N74-31429 21-02)
(Contract F08635-71-C-0227)

A technique is demonstrated which permits the numerical solution of the linear optimal regulator problem to be used as a generalized design tool. In particular this technique affords simplification over the usual frequency domain methods for high order guidance and control systems while retaining compatibility with the frequency domain especially for stability analysis. In addition to making a more rapid solution to the design problem possible, the structure of the optimal controller lends itself to the combination of the guidance and control problems into a single optimum or best solution. Author

N74-31438 Norges Tekniske Hoegskole, Trondheim.
OPTIMAL CONTROL OF STOCHASTIC SYSTEMS WITH UNSPECIFIED TERMINATION TIMES
Rolf Henriksen *In* AGARD Advan. in Control Systems May 1974 10 p refs (For availability see N74-31429 21-02)

A game-theoretic approach to optimal control problems of discrete-time stochastic systems with unspecified termination times is presented. In somewhat the same sense as stochastic systems with fixed termination times may be regarded as a kind of single-experiment (fixed samplesize) games, stochastic systems with unspecified termination times may be regarded as a kind of sequential games. A major part of the paper is devoted to the synthesis of Bayes control policies for truncated control processes, a term which is quite analogous to truncated sequential games. Two simple examples are given. Author

N74-31439 Royal Aircraft Establishment, Farnborough (England). Avionics Dept.
FLIGHT CONTROL SYSTEM DEVELOPMENT IN THE UK
D. Kimberley and P. W. J. Fullam *In* AGARD Advan. in Control Systems May 1974 13 p refs (For availability see N74-31429 21-02)

The development of automatic flight control systems in the U.K. is described. Military and civilian applications of control system development are reported. The requirements of a control system are defined with respect to mission performance, system integration, similar redundancy, and control actuation. Specific examples of control installation and flight test results are included. The flight test results indicate that a full time fly by wire system is feasible and represents a prerequisite to system exploitation in the form of such concepts as control configured vehicles. Author

N74-31440 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

F-15 EAGLE FLIGHT CONTROL SYSTEM
Edward H. McDonald *In* AGARD Advan. in Control Systems May 1974 8 p (For availability see N74-31429 21-02)

The high performance demands of the flight control systems of today's fighter type aircraft normally are associated with undesirable complexity. How this complexity was minimized, the hardware solution to historical design problems, and how the solution evolved are discussed. A narration includes the pre-hardware design phase during which time exhaustive simulator analyses were made. The unique integration of flight controls with other aircraft systems is revealed along with limited performance and test results. The more significant subcomponents/systems are separately addressed; namely the automatic flight control system, the stabilator actuator, and the control stick boost and pitch compensator package. In conclusion, overall salient capabilities are enumerated which substantiates the existing high confidence level relative to the system. Author

N74-31441 Thomson-CSF, Issy les Moulineaux (France). Groupe Optronique de la Div.
NEW CONCEPTS OF VISUALIZATION FOR AIRCRAFT AND SPACE SHUTTLES [NOUVEAUX CONCEPTS DE VISUALISATION POUR AVIONS ET NAVETTES SPATIALES] c14
M. Coussediere *In* AGARD Advan. in Control Systems May 1974 9 p In FRENCH (For availability see N74-31429 21-02)

Instrumentation systems adaptable to aircraft and space shuttle visualization concepts are reported. The systems considered include head-up displays, electric attitude direction indicators, electric horizontal situation indicator, engine display, multi-function display, and radar visualization meters. Simulation results and possible advantages of these systems over conventional ones are discussed. Transl. by E.H.W.

N74-31442 Royal Aircraft Establishment, Farnborough (England). Controls and Displays Div.
ON THE DESIGN AND EVALUATION OF FLIGHT CONTROL SYSTEMS
F. R. Gill *In* AGARD Advan. in Control Systems May 1974 13 p refs (For availability see N74-31429 21-02)

An analysis of flight test results of control systems for fighter and transport aircraft is presented. The systems under consideration employ conventional linear control policies with the design being based on a parameter optimization technique. The two modes which are discussed are a pitch rate maneuver demand system for the fighter aircraft and an ILS glide path and flare system for the transport aircraft. Studies to replace linear control by variable gain policies are discussed. The reasons for and the principles of the variable gain control policies are outlined. The principles of flight evaluation methods employed with the control system tests are included. Author

N74-31443 Honeywell, Inc., Minneapolis, Minn.
A FLY-BY-WIRE FLIGHT CONTROL SYSTEM FOR DECOUPLED MANUAL CONTROL
A. J. VanDierendonck, K. Bassett (AFFDL), and E. E. Yore *In* AGARD Advan. in Control Systems May 1974 7 p refs (For availability see N74-31429 21-02)
(Contract F33615-72-C-1266)

A sight line autopilot (SLAP) was designed for the AC-130 Gunship to improve the gun pointing ability. This paper presents the unique design procedure and development philosophy that was used. It emphasizes the peculiarities of this weapon delivery concept, the problem areas and the results of the design. Multi-axes coupling, digital computer control, available measurements, and optimistic performance requirements prompted the use of modern control design techniques. Optimal control laws were generated for all modes and submodes. No classical analysis was performed. Proportional-plus-integral control was included to reduce nonlinear effects. Both linear and nonlinear simulation results verified that the autopilot met the optimistic performance requirements in spite of poor performing servo-actuators, which limited the bandwidth of control laws. More recently, ground and flight tests have been performed. Author

N74-31444 Laboratoire Central de Telecommunications, Paris (France).
DEFINITION AND SIMULATION OF A DIGITAL FILTER AND PILOT DEVICE UTILIZING MODERN DESIGN TECHNIQUES OF FILTRATION CONTROL [DEFINITION ET SIMULATION D'UNE BOUCLE DIGITALE DE PILOTAGE D'ENGIN UTILISANT LES TECHNIQUES MODERNES DE FILTRAGE ET DE COMMANDE]
C. A. Darmon and H. Euzen *In* AGARD Advan. in Control Systems May 1974 13 p refs In FRENCH (For availability see N74-31429 21-02)

Modern optimal control techniques used to define and simulate digital filters for pilot devices are discussed. Noise measurements, system dynamics, and physical properties of the device are examined. Transl. by E.H.W.

N74-31445 Advisory Group for Aerospace Research and Development, Paris (France).
AN EXPERIMENTAL INVESTIGATION INTO DUPLEX DIGITAL CONTROL OF AN ENGINE WITH REHEAT c28
J. F. O. Evans and K. A. Helps *In its* Advan. in Control Systems May 1974 14 p (For availability see N74-31429 21-02)

The application of cross-monitoring computers with a hydromechanical back-up system to control a P.S. 50 jet engine is discussed. The choice of a digital control system was based on the complexity of modern engine control requirements especially at the reheat end of the system. Total hydromechanical control without the computer results in complexity and increased costs. The digital system is well suited to the functions of scheduling, decision making, time-varying parameters, and nonlinearity conditions. The features of the digital equipment in high integrity systems are analyzed. The basic control system and the reversionary mode of the system are examined. The results of performance tests using the computer controlled system are reported. Author

N74-31446 Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF REDUNDANT DIGITAL COMPUTERS TO FLIGHT CONTROL SYSTEMS
R. L. Schoenman *In* AGARD Advan. in Control Systems May 1974 13 p (For availability see N74-31429 21-02)

The use, operations, and failure modes of a redundant digital system for aircraft control are discussed. Emphasis is placed on the flight critical aspects such as automatic landing, command augmentation, and fly by wire control. The rationale for selecting digital flight control systems is explained. Specific application of digital flight control systems to the supersonic transport aircraft is analyzed. The system topics which are affected by the digital system are: (1) effect of cross-channel voting on reliability, (2) cross-channel voting mechanization, (3) input-output interface, and (4) the effect of actuator configuration. Block diagrams are included to show the interrelationships of the computer signals and components. Author

N74-31447 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
REALIZATION AND FLIGHT TESTS OF AN INTEGRATED DIGITAL FLIGHT CONTROL SYSTEM
Robert K. Zach *In* AGARD Advan. in Control Systems May 1974 20 p refs (For availability see N74-31429 21-02)

The introduction of digital computers into modern aircraft control systems for the integration of all the functions in a complex automatic flight control system is discussed. In order to realize such practical systems economically, the functional requirements for the computer and interface were first derived by the analysis of the tasks and by the hybrid simulation of the functions, where the aircraft and actuators were simulated on an analog computer and the AFCS on a general purpose digital computer. Based on these requirements, a free programmable in-flight simulator was designed, built and flown in the test aircraft. This equipment is compatible with the laboratory hybrid simulation equipment. The in-flight simulator allows experiments of different control laws, and was used to check and prove the required control form for a special digital system developed for flight control. As is shown, this latter system fulfills all the functional requirements and consists of a small digital computer, an interface for signal conversion and a pilots control panel. All functions of a modern AFCS, such as stabilizer, automatic approach, automatic landing and other autopilot functions as well as preflight and inflight tests were integrated, by programming the semiconductor mermory. The flight trials of this system in the test aircraft showed the satisfactory functioning of the system over the whole

aircraft flight envelope. The good control characteristics were confirmed with the measured responses in flight. Author

N74-31448 LTV Aerospace Corp., Dallas, Tex. Systems Div.
APPLICATION OF DIGITAL FLY-BY-WIRE TO FIGHTER/ATTACK AIRCRAFT
Ryland A. Baldwin *In* AGARD Advan. in Control Systems May 1974 10 p refs (For availability see N74-31429 21-02)

Some of the benefits to be derived from digital fly-by-wire flight control systems applied to attack/fighter aircraft are presented. An integrated stability augmentation system and control augmentation system mechanization is described. Design criteria are reviewed and trade studies that were made to establish the proper level of redundancy are described. The resulting quadruplex system configuration is presented showing interfaces with digital processors. Computer studies undertaken to support selection of the proper digital word length and iteration rate are summarized, and the effect of variations of these parameters upon system performance is shown. A brief description of the data handling system and the computer requirements are included along with a block diagram summarizing the integrated system. Performance of the digital flight control system is compared to that of the analog system now in use in the A-7 aircraft. Open loop test data of a laboratory test configuration in which aircraft control laws are programmed are given. Author

N74-31449 Marconi-Elliott Avionic Systems Ltd., Rochester (England). Flight Controls Div.
THE DESIGN AND DEVELOPMENT OF THE MRCA AUTOPILOT
D. I. Jackson and J. M. Corney *In* AGARD Advan. in Control Systems May 1974 11 p (For availability see N74-31429 21-02)

The design and development of an autopilot and a flight director system are described. Emphasis is placed on the problem of ensuring flight safety in the low altitude autopilot modes. The subjects considered are: (1) design philosophy, (2) system configuration and control, (3) hardware development, and (4) software implementation. The system is designed to provide automatic control of the aircraft in putch and lateral planes in a variety of operating modes. A flight director is included which provides signals to the pilot's instruments to enable the pilot to monitor the autopilot performance and to use the signals for flight path guidance if an autopilot malfunction occurs. Author

N74-31450* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
DESIGN AND FLIGHT EXPERIENCE WITH A DIGITAL FLY-BY-WIRE CONTROL SYSTEM IN AN F-8 AIRPLANE
Dwain A. Deets and Kenneth J. Szalai *In* AGARD Advan. in Control Systems May 1974 10 p refs (For availability see N74-31429 21-02)
CSCL 01C

A digital fly-by-wire flight control system was designed, built, and for the first time flown in an airplane. The system, which uses components from the Apollo guidance system, is installed in an F-8 airplane as the primary control system. A lunar module guidance computer is the central element in the three-axis, single-channel, multimode, digital control system. A triplex electrical analog system which provides unaugmented control of the airplane is the only backup to the digital system. Flight results showed highly successful system operation, although the trim update rate was inadequate for precise trim changes, causing minor concern. The use of a digital system to implement conventional control laws proved to be practical for flight. Logic functions coded as an integral part of the control laws were found to be advantageous. Although software verification required extensive effort, confidence in the software was achieved.
Author

N74-31451 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
DIGITAL FLY-BY-WIRE CONTROL SYSTEM WITH SELF-DIAGNOSING FAILURE DETECTION
R. Onken, H. P. Joenck, L. Tacke, and M. Gottschlich *In* AGARD Advan. in Control Systems May 1974 7 p refs (For availability see N74-31429 21-02)

A solution is presented to the problem of achieving real fail-safe behaviour for fly-by-wire systems, no longer depending on the reliability of the monitor/voter device and the probability of the occurrence of dormant errors. This is accomplished by the use of stand-by redundancy in conjunction with selfdiagnosing failure detection which is independent of the control signal state. Each redundant unit is autonomous with respect to the failure detection, such that, depending on the inspection rate, perfect information about the reliability status of the system, including the failure detection itself, is available at any time. The feasibility of this approach is demonstrated by the fly-by-wire system which is installed and successfully flown in a HFB 320 jet aircraft.
Author

N74-31452 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
B-52 CONTROL CONFIGURED VEHICLES PROGRAM
R. P. Johannes and G. O. Thompson *In* AGARD Advan. in Control Systems May 1974 10 p refs Prepared in cooperation with Boeing Co. (For availability see N74-31429 21-02)

A test program to evaluate the control configured vehicles (CCV) program is discussed. The purpose of the program is to validate achievable results of the CCV system concepts on large flexible aircraft, such as the B-52. The four concepts which are involved in the flight test are: (1) ride control, (2) flutter mode control, (3) maneuver load control, and (4) augmented stability. The potential benefits of the CCV concept and the results of the ride control system flight tests are analyzed. Author

N74-31453 National Aerospace Lab., Amsterdam (Netherlands).
FLIGHT EXPERIENCE WITH AN EXPERIMENTAL ELECTRICAL PITCH-RATE-COMMAND/ATTITUDE-HOLD FLIGHT CONTROL SYSTEM
H. A. Mooij *In* AGARD Advan. in Control Systems May 1974 8 p refs (For availability see N74-31429 21-02)

The introduction of electrical primary flight control systems makes studies in many aspects of their application highly desirable. One important aspect is the development of handling qualities criteria as a guide for system design. To this end an experimental pitch-rate-command/attitude-hold flight control system installed in a Beechcraft Queen Air-80 was used in two flight research programs. Results of these programs are discussed in this paper. The first program is related to pilot workload reduction for the safe execution of two-segment noise-abatement approaches. The other program is aimed at in-flight determination of pilot-aircraft system performance as well as pilot describing function and remnant information. Author

N74-31454 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
INTEGRATED FLIGHT CONTROL SYSTEM FOR STEEP APPROACH
Gunther Schaenzer and Hartmut H. Boehret *In* AGARD Advan. in Control Systems May 1974 12 p refs (For availability see N74-31429 21-02)

The approach of extremely short runways surrounded by high obstacles has to be made on steep and curved approach profiles. The flight path and the aerodynamic flow condition have to be controlled more accurately as compared with conventional approach procedures. The resulting problems concerning flight mechanics and control will be discussed and the requirements for an integrated flight control system will be derived. The characteristics of a sub-optimal flight control system controlling the flight path and the aerodynamic flow condition via elevator and throttle with limited state vector feedback will be demonstrated by simulation- and flight tests results for automatic approach and landing. Author

N74-31455 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
V/STOL AIRCRAFT CONTROL/DISPLAY CONCEPT FOR MAXIMUM OPERATIONAL EFFECTIVENESS
Kenneth W. McElreath, James A. Klein (Collins Radio Co.), and Ralph C. Thomas (Collins Radio Co.) *In* AGARD Advan. in Control Systems May 1974 8 p refs (For availability see N74-31429 21-02)

Vertical/Short Takeoff and Landing (V/STOL) aircraft and their unique missions define four requirements for a practical and suitable IFR control/display system: (1) maximum flight

profile flexibility, (2) flight control precision, (3) low pilot workload, and (4) simplicity at low cost. A system concept which has made significant progress in meeting these requirements is described. The system concept is that of retaining the human pilot as an active control element, augmented by an integrated system of displays, steering computation, and automatic control elements. The task allocation between the pilot and the automatic portion of the system optimizes the pilot's flexibility and control effectiveness in the control tasks for which he is most suited, complemented by the precision and reduction in workload afforded by automatic control techniques. The approach taken in the development of the system was to first define the mission tasks to be performed and the system constraints. Analysis and pilot-in-the-loop simulation determined the most effective control scheme and the optimum human-automatic interface. Flight testing then validated the system concepts in hardware form aboard a CH-3E helicopter test bed. Author

N74-31456 Royal Aircraft Establishment, Bedford (England).
AUTOSTABILIZATION IN VTOL AIRCRAFT: RESULTS OF FLIGHT TRIALS WITH SC 1
H. W. Chinn *In* AGARD Advan. in Control Systems May 1974 16 p refs (For availability see N74-31429 21-02)

The flight control system developed for the SC 1 jet lift VTOL research aircraft is described and an account given of its behaviour throughout the flight envelope: vertical take-off and landing, transition and conventional flight. The system, which provided artificial directional stability in the yaw and maneuver demand in the pitch and roll axes, gave a stable aircraft while retaining a high degree of maneuverability. Comparison is made with existing handling criteria and the ways in which demand systems inevitably contravene certain of these criteria are discussed. Author

N74-31457* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TEST OF AN AUTOMATIC APPROACH AND LANDING CONCEPT FOR A SIMULATED SPACE SHUTTLE REPRESENTED BY THE NASA CONVAIR 990 AIRCRAFT
Donald W. Smith, Frederick G. Edwards, John D. Foster, and Fred J. Drinkwater, III *In* AGARD Advan. in Control Systems May 1974 9 p refs (For availability see N74-31429 21-02) CSCL 01C

Unpowered automatic approaches and landings were conducted to study navigation, guidance, and control problems associated with terminal area, approach, and landing operation for the space shuttle. A Convair 990 aircraft was equipped with a digital flight-control computer connected to the aircraft control systems and displays. The flight tests evaluated, from 11,300 m to touchdown, the performance of a navigation and guidance concept that utilized blended radio/inertial navigation with VOR, DME, and ILS as the ground radio navigation aids. The results from 36 automatic approaches and landings are analyzed. Preliminary results indicate that this concept may provide sufficient accuracy that automatic landing of the unpowered shuttle orbiter can be accomplished on a conventional size runway. Author

N74-31458# Advisory Group for Aerospace Research and Development, Paris (France).
AIRCRAFT DESIGN INTEGRATION AND OPTIMIZATION, VOLUME 1
Jun. 1974 347 p refs In ENGLISH; partly in FRENCH Conf. held at Florence, Italy, 1-4 Oct. 1973
(AGARD-CP-147-Vol-1) Avail: NTIS HC $20.50

The proceedings of a conference on aircraft design integration and optimization are presented. The subjects discussed include the following: (1) the preliminary design process and its impact on cost, (2) methods and approaches for balancing requirements, capabilities, and costs in aircraft design, (3) analysis, optimization, and validation testing techniques, and (4) the integration of subsystems and application of new technology. For individual titles, see N74-31459 through N74-31484.

N74-31459 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE ROLE OF PRELIMINARY DESIGN IN REDUCING DEVELOPMENT, PRODUCTION AND OPERATIONAL COSTS OF AIRCRAFT SYSTEMS
William E. Lamar *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 7 p (For availability see N74-31458 21-02)

Methods for reducing the development, production, and operational costs of aircraft systems through preliminary design procedures are discussed. The manner in which the preliminary design process is conducted is analyzed. The critical program decisions which are made on the basis of the preliminary design process are identified. The preliminary process is further defined to show the application for assessing the payoff of technical innovations and emerging technologies on system capabilities. Diagrams are provided to show the preliminary design flow chart, system program phases, preliminary design process uses, and cost reduction methodologies. Author

N74-31460 General Dynamics/Fort Worth, Tex.
PRELIMINARY DESIGN ASPECTS OF DESIGN-TO-COST FOR THE YF-16 PROTOTYPE FIGHTER
William C. Dietz *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 16 p (For availability see N74-31458 21-02)

Methods for reducing the development costs of the YF-16 aircraft are discussed. The YF-16 prototype aircraft was conceived and is being developed as a low-cost, exceptionally high-maneuvering-performance fighter aircraft. To meet the cost/performance objectives, a number of advanced technology features, including vortex lift, variable wing camber, wing/body blending, relaxed static stability/fly-by-wire, and high-performance normal-shock inlet, were optimized and integrated during the preliminary design phase. The basic design concept was to apply these advanced technologies in a way, first, to produce a small-size aircraft and, second to achieve simplicity - both of these design objectives having a direct beneficial effect on the development, acquisition, and life-cycle cost. The resulting configuration is predicted to meet all program cost/performance objectives. Author

N74-31461 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ECONOMIC ASPECTS OF PROTOTYPING
Erich Rutzen *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 5 p refs (For availability see N74-31458 21-02)

The cost aspects and schedule implications involved in a prototype development concept are compared with standardized development philosophies. The time scales of the total system development program and the time scales of the prototype development program are illustrated. The procedures involved in conducting a comparative cost analysis are reported. Diagrams are included to show the budget requirements, accumulated costs at program milestones, specifications uncertainties, and the confidence factor. Organizational charts for the total system development concept and the prototype development concept are also compared. Author

N74-31462 Douglas Aircraft Co., Inc., Long Beach, Calif.
CREATIVE ADVANCED DESIGN: A KEY TO REDUCED LIFE-CYCLE COSTS
Richard E. Black and John A. Stern *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 13 p refs (For availability see N74-31458 21-02)

Advanced design decisions with an impact upon the life cycle costs of aircraft systems are discussed. The impact of advanced design decisions commences during the detail design and development phases, continues into the production phase and becomes a dominant factor during the operational life of the aircraft system. Even for a well defined mission there are many factors bearing on costs that must be considered during the advanced design phase. Several of these have been selected for examination: (1) the number of engines to be used, (2) selection of equipment and systems, (3) the simplification of design, (4) the materials to be used, and (5) the level of avionics sophistication. These advanced design decisions cannot be made solely from a technical or cost standpoint, but must consider the operational environment in which the aircraft system will function as well as the demands of the market place. There are strong indications that the more intense the advanced design

effort the lower will be the detailed design, manufacturing and development costs as well as life cycle costs. During the advanced design phase, it is extremely important that the critical wind-tunnel tests be performed to avoid costly redesign after the detailed design drawings have been released. The contribution that creative Advanced Design makes to the development of effective aircraft systems has greatly increased as the result of rising costs. Errors in judgement are now more costly than ever before. Author

N74-31463 Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
CRITICAL ANALYSES AND LABORATORY RESEARCH WORK AT THE STAGE OF AIRCRAFT PRELIMINARY DESIGN
Claude Lievens and Philippe Poisson-Quinton *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 26 p ref In FRENCH; ENGLISH summary (For availability see N74-31458 21-02)

The requirements to be met by a research laboratory in preparation for the preliminary design phase of sophisticated aircraft development are analyzed. It is stated that the research center must forecast the main trends of aeronautical techniques in order to provide the government services and the constructors with a maximum of information. The required actions of the government technical services are defined to include: (1) generation of preliminary studies for contractor use, (2) to begin basic research studies, (3) to identify technical risks, and (4) to monitor the progress of works under development and reorient the effort where required. Author

N74-31464* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTERIZED PRELIMINARY DESIGN AT THE EARLY STAGES OF VEHICLE DEFINITION
Thomas J. Gregory *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 8 p refs (For availability see N74-31458 21-02)
CSCL 01B

The conceptual and preliminary design processes are used to provide information regarding the feasibility and selection of various approaches to aircraft mission requirements. Decisions influenced by this information often have enormous cost implications at the later stages of the development process and during vehicle operation, yet the resources expended during the early phases are usually relatively small and distributed over several alternate approaches. The information provided during these early conceptual and preliminary design phases needs to be credible and complete, even though it must be generated with limited resources. Criteria for acceptance of early design information, modern methods of providing it and suggestions for defining adequate levels of resources to accomplish the objectives of the activity are described. Specific examples of the most difficult type of early design studies, which are those requiring significant undeveloped technology, are used to discuss these points. The examples include design studies and cost estimates of liquid hydrogen fueled aircraft, oblique winged aircraft, and remotely piloted vehicles. Author

N74-31465 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
PRELIMINARY DESIGN TECHNIQUES FOR UNMANNED, REMOTE PILOTED VEHICLES
R. Staufenbiel and H. Schmidtlein *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 14 p (For availability see N74-31458 21-02)

The steps involved in the design of remotely piloted vehicles are discussed. Specific areas of concern are: (1) combat tactics, (2) weaponry, (3) sensors, (4) payload and range, (5) guidance and control, and (6) maintainability, storability, and vulnerability. The characteristics of a typical RPV are analyzed to provide an example of the important factors which are involved in the design procedure. Author

N74-31466 Hawker Siddeley Aviation, Ltd., Hatfield (England).
AN APPROACH TO DESIGN INTEGRATION
Anthony W. Bishop and Alan N. Page *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 16 p refs (For availability see N74-31458 21-02)

The nature of an aircraft design team and the techniques to be integrated into the organization to improve design efficiency are discussed. The structure and implementation of new techniques which have been applied to the preliminary stages of design in Hawker Siddeley Aviation are stressed. Block diagrams are developed to show the data base mechanism, the interaction between applications programs and the data base, and the flow of typical project study activities. The costs and benefits of the system of design are analyzed. Author

N74-31467 Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN EVOLUTION OF THE BOEING 2707-300 SUPERSONIC TRANSPORT. PART 1: CONFIGURATION DEVELOPMENT, AERODYNAMICS, PROPULSION, AND STRUCTURES
W. C. Swan *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 18 p (For availability see N74-31458 21-02)

The design activities involved in developing the Boeing 2707 supersonic transport aircraft are discussed. The history of the design activity is presented to show areas where failure and/or misconception occurred due to insufficient knowledge and to show how the shortcomings were corrected or avoided in subsequent configuration evaluations. Emphasis is placed on selected areas where preliminary design tools could be improved. The various design configurations are illustrated and their technical features are analyzed. The structural design features of various components are described and illustrated. The operational objectives on which the preliminary planning was based are defined. The functions of specific segments of the organization are reported. Author

N74-31468 Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN EVOLUTION OF THE BOEING 2707-300 SUPERSONIC TRANSPORT. PART 2: DESIGN IMPACT OF HANDLING QUALITIES CRITERIA, FLIGHT CONTROL SYSTEM CONCEPTS, AND AEROELASTIC EFFECTS ON STABILITY AND CONTROL
W. T. Kehrer *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 10 p refs (For availability see N74-31458 21-02)

The intensive efforts undertaken to develop an economically competitive SST are discussed. New design approaches in the areas of airplane longitudinal control and stability and flight control systems design were developed. Extensive research work was conducted to push the state of the art as hard as possible in the development of handling qualities criteria and in the design evolution of the stability augmentation system. The end product was a control-configured vehicle employing multiple redundant electronic stability augmentation systems to meet design requirements for both normal handling qualities and minimum-safe handling qualities. This design approach contributed substantial gains in range/payload capability over that attainable through the conventional approach that inhibits airplane design through the requirement to provide inherent aerodynamic stability. Throughout all of the design development work the effects of structural aeroelastics on aircraft stability and control played a major role in configuration design decisions. The complex engineering work involved in the aeroelastic analyses paced the configuration development design cycles and contributed substantially to the total engineering costs. The experience gained in these areas has identified the need for improved quality, automated aeroelastic analysis methods to speed the design development work and reduce the engineering costs and design risks. Author

N74-31469 British Aircraft Corp., Preston (England). Military Aircraft Div.
RECENT EXPERIENCE FROM BAC AIRCRAFT FOR NATO
P. J. Midgley *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 10 p ref (For availability see N74-31458 21-02)

An analysis of trends in total cost of ownership of combat aircraft was developed. The life cycle cost analysis is related to the Air Force budget and ways are considered in which the rising costs of Air Force operations may be alleviated. The subjects discussed include the following: (1) Air Force budget trends, (2) the procurement process, (3) life cycle costs, (4) launch and

acquisition costs, (5) development philosophy, (6) operating costs, and (7) training costs. Charts, graphs, and diagrams are included to illustrate the contents of the text. Author

N74-31470 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

THE F-15 DESIGN CONSIDERATIONS

Harry E. Rifenbark and Richard D. Highet *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 11 p (For availability see N74-31458 21-02)

The major design considerations of the F-15 air superiority aircraft are traced from the initial requirements, through the design, and into the flight testing. Selection of the overall configuration is discussed with particular emphasis on the wing, inlet, and secondary power design. The ground and flight test programs are briefly reviewed. Author

N74-31471 Dornier-System G.m.b.H., Friedrichshafen (West Germany).

SYSTEM ANALYSIS FOR A BATTLE-FIELD AIR SUPERIORITY FIGHTER PROJECT WITH RESPECT TO MINIMUM COST

Johannes Spintzyk *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 14 p refs (For availability see N74-31458 21-02)

The battle-field air superiority fighter is an air defense aircraft with the function to gain and to hold air superiority over the combat area for limited time and limited operational area. For given budget the fleet effectiveness can be optimized by reducing the price of the aircraft thus allowing for a higher number of aircraft. Mainly a low cost design can be achieved by minimizing the take-off weight. Design philosophy is to adjust range, payload and equipment to absolute necessary requirements thus arriving to a simple design, but not to compromise air combat capability. For the evaluation of different solutions a method is discussed which shows the role of aircraft characteristics with respect to air combat and which can be used in the preliminary design phases. In the present paper, the influence of mission and design parameters of range, combat time, wing loading and thrust/weight ratio on take-off weight, system cost and air combat effectiveness for the battle-field air superiority fighter is shown. Different versions of a battle-field air superiority fighter are presented and comparative results shown. Author

N74-31472 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

THE B-1 BOMBER: CONCEPT TO HARDWARE

Robert J. Patton *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 10 p (For availability see N74-31458 21-02)

The development of the B-1 bomber aircraft is traced from the initial conceptual studies to the hardware production. The interaction of the B-1 requirements and advanced technology is emphasized. The preliminary design process is examined and the hardware product is compared with earlier designs. The lessons learned from the analysis are summarized. The mission of the B-1 aircraft is defined and specific operational requirements are considered to show the rationale of design decisions. Author

N74-31473 Boeing Aerospace Co., Seattle, Wash. Aeronautical and Information Systems Div.

DESIGN OF VERY LARGE AIRPLANES FOR LEAST SYSTEM COST

Robert B. Brown *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 6 p (For availability see N74-31458 21-02)

An analysis was conducted to determine the design and development techniques for large aircraft which would result in the least system cost. The effects of program and total life cycle costs are examined to show the effects on starting new aircraft development. Methods for designing an aircraft to maintain low cost are described and illustrated. Specific examples of aircraft designed for various missions are investigated to show the various approaches which were taken to keep down development costs. Author

N74-31474* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTEGRATED, COMPUTER AIDED DESIGN OF AIRCRAFT

R. R. Heldenfels *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 12 p refs (For availability see N74-31458 21-02)

CSCL 01B

The design process for conceptual, preliminary, and detailed design of aircraft is discussed with emphasis on structural design. Problems with current procedures are identified and improvements possible with an optimum man-computer team using integrated, disciplinary computer programs are indicated. Progress toward this goal in aerospace and other industries is reviewed, including NASA investigations of the potential development of Integrated Programs for Aerospace-Vehicle Design (IPAD). The benefits expected from IPAD lead to the conclusion that increased use of the computer by a man-computer team that integrates all pertinent disciplines can create aircraft designs better, faster, and cheaper. Author

N74-31475 Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

PROJECT WEIGHT PREDICTION BASED ON ADVANCED STATISTICAL METHODS

Wolfgang Schneider *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 20 p refs (For availability see N74-31458 21-02)

A survey of the possibilities of mathematical statistics for engineering evaluation of reliable data sets for design weight estimates of first level accuracy was conducted. Based on a form of regression analysis, several statements which are adapted for finding weight prediction formulas are described. The two principle statements are: (1) constraint regression for development formulas which give physically interpretable weight trends, using methods of quadratic optimization and (2) nonlinear regression statements which are solved by using iterative computer routines. Practical examples to show the possibilities of applying statistical evaluations are included. Author

N74-31476 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

POTENTIAL PAYOFF OF NEW AERODYNAMIC PREDICTION METHODS

Richard H. Klepinger and Robert Weissman *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 17 p refs (For availability see N74-31458 21-02)

The trade studies and design compromises to optimize the aircraft configuration for specific purposes are discussed. Typical problems involved in the aircraft design process are examined. Illustrations are provided to show the performance improvement which resulted from design modifications to various aircraft. Methods for accurately predicting the performance of an aircraft prior to flight test are reported. Design criteria based on lateral-directional static stability have been developed to reveal possible problems relative to departure characteristics and spin susceptibility. It is stated that the application of three dimensional aerodynamic analysis methods and spin prevention criteria early in the development of a new aircraft may be the key to better design optimization and improved integration of the components. Author

N74-31477 Royal Aircraft Establishment, Farnborough (England).

INITIAL-DESIGN OPTIMISATION ON CIVIL AND MILITARY AIRCRAFT

D. L. I. Kirkpatrick and M. J. Larcombe *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 18 p refs (For availability see N74-31458 21-02)

The development of a computer program which can optimize the preliminary design of a subsonic, swept-wing, jet transport aircraft is discussed. The program can be used to assess rapidly the effects on the optimum design of changes in the specified performance or of advances in aerodynamic, structural, or engine technology. Compound optimization functions, including several of the aircraft characteristics, with different weighting factors can be used to produce designs in which large improvements in some characteristics have been obtained with small penalties in others. Author

N74-31478 Societe Nationale Industrielle Aerospatiale, Paris (France).

NEW TECHNOLOGIES AND MAINTENANCE OF HELICOPTERS
Jacques Andres *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 13 p In FRENCH (For availability see N74-31458 21-02)

Two fundamental criteria are proposed to study helicopter maintenance: specific costs which constitute the reference for the purchase price of the helicopter and the specific operational price which constitutes the reference cost in helicopter utilization. Data are also given on the problem of cost of performance, security, and comfort in helicopter design. The contribution of new technologies to actual helicopter cost effectiveness was evaluated. Transl. by E.H.W.

N74-31479 Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
DESIGN OPTIMIZATION OF THE VAK 191B AND ITS EVALUATION BASED ON RESULTS FROM THE HARDWARE REALISATION AND TEST DATA
Rolf Riccius and Bernhard Wolf *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 19 p refs (For availability see N74-31458 21-02)

The design optimization procedure for the VAK 191B fighter aircraft is discussed. The procedure of design optimization is evaluated based on the results obtained from ground and flight tests. The emphasis in the original planning was placed on aircraft performance. The results of the tradeoff studies in combination with point design studies are reported. The different approaches to the power plant selection are defined. The rationale behind the final selection of the aerodynamic configuration is explained. Author

N74-31480 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONCEPT CCV AND SPECIFICATIONS
Jean-Claude Wanner *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 6 p In FRENCH; ENGLISH summary (For availability see N74-31458 21-02)

The application of the control configured vehicle (CCV) concept to the design stage of new aircraft is discussed. The systems considered under the CCV concept are: (1) static stability compensation, (2) maneuver load control, (3) active ride control, and (4) active flutter control. The overall goal of the CCV concept is to take advantage of the most recent technological progress in electronics and to make use of new types of control actuators in order to satisfy the compromise between performance, handling qualities, lifetime, and cost. Author

N74-31481 Boeing Co., Wichita, Kans.
INTRODUCTION OF CCV TECHNOLOGY INTO AIRPLANE DESIGN
Richard B. Holloway *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 16 p refs (For availability see N74-31458 21-02)

The control configured vehicle (CCV) aircraft design process is compared with conventional design procedures. The CCV procedure capitalizes on the potential of considering advanced flight control concepts during the initial parametric studies and trades. Formulation of the parametric aircraft can also be altered by the CCV approach, since traditional empirical design procedures no longer necessarily apply. CCV studies indicate that the most significant performance improvements are achieved in the following functions: (1) augmented stability, (2) gust load alleviation, (3) maneuver load control, (4) fatigue reduction, (5) ride control, and (6) flutter mode control. Author

N74-31482 Lockheed-Georgia Co., Marietta.
AVIONIC FLIGHT CONTROL SUBSYSTEM DESIGN AND INTEGRATION IN THE C-5 AIRPLANE **c03**
W. Elton Adams *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 12 p refs (For availability see N74-31458 21-02)

The preliminary design process influence on the C-5 avionic flight control system development, production, and operational cost is discussed. The design decisions made during the preliminary design phase relative to the stability augmentation systems illustrate the extent of the impact on the design, test, manufacture, and installation of the avionic systems. These decisions lie mainly in the areas of mission success capability, airplane safety, reliability, survivability, and human factor characteristics and, for the illustrative stability augmentation systems, the aircraft's handling qualities. The design processes, including the subsystem integration with the airframe and with other functional subsystems, influenced the cost of the C-5 program. Experience gained from this program may lead to improvements in preliminary design decision making procedures. Author

N74-31483 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ADVANCEMENTS IN FUTURE FIGHTER AIRCRAFT
Wolfgang Herbst *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 7 p refs (For availability see N74-31458 21-02)

An analysis of advanced design technology as applied to future fighter aircraft was conducted. The following conclusions were reached: (1) a new aircraft development can be justified if the performance of the new aircraft exceeds that of the old by 15 to 20 percent, (2) foreseeable technological air frame advances, such as CCV and composites, do not justify the development of new weapon systems, per se, (3) refent engine technology advances allows a performance improvement which will justify new aircraft design, and (4) foreseeable air frame advances will pay off if applied to new aircraft development. Author

N74-31484 Ministry of Defence, London (England).
ESTIMATION OF PROGRAMMES AND COSTS FOR MILITARY AIRCRAFT **c34**
J. C. Morrall *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 14 p (For availability see N74-31458 21-02)

The purposes, history and methods of budgetary estimation for military aircraft development programs conducted by the United Kingdom are discussed. The derivation of the methods are analyzed using the airframe as the main example. The use of the timescale, resources, and cost estimating techniques to provide cost trade-offs for different aircraft operational capabilities is demonstrated. The main purposes served by the budgetary estimate are: (1) planning and funding, (2) project selection, appraisal, and approval, and (3) assessment of future loading on the aircraft industry for aerospace policy decisions. Author

N74-31485*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DELTA WING
Theodore R. Creel, Jr. and Jim A. Penland Aug. 1974 78 p refs
(NASA-TM-X-71974) Avail: NTIS HC $4.00 CSCL 01C

An experimental investigation of the low-speed static longitudinal, lateral and directional stability characteristics of a hypersonic research airplane concept having a 70 deg swept delta wing was conducted in a low-speed tunnel with a 12-foot (3.66 meter) octagonal test section. Aircraft component variations included: (1) fuselage shape modifications, (2) tip fins, (3) center vertical fin, (4) wing camber, and (5) wing planform. This investigation was conducted at a dynamic pressure of 262.4 Pa (5.48 psf), a Mach number of 0.06, and a Reynolds number of 2.24 million, based on body length. Tests were conducted through an angle-of-attack range of 0 deg to 30 deg with elevon deflections from +5.0 deg to minus 30.0 deg. The complete configuration exhibited positive static longitudinal, lateral and directional stability up to angles of attack of at least 20 deg and was trimmable to lift coefficients of at least 0.70 with elevon deflections of minus 30 deg. Author

N74-31486*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
PARAMETRIC STUDY OF STOL SHORT-HAUL TRANSPORT ENGINE CYCLES AND OPERATIONAL TECHNIQUES TO MINIMIZE COMMUNITY NOISE IMPACT Final Report
E. P. Schuld, J. P. Crovello, J. H. Lindley, L. H. Quick, F. S. LaMar, and R. H. Young Jun. 1974 418 p refs
(Contract NAS2-6994)
(NASA-CR-114759; MDC-J4437) Avail: NTIS HC $24.00 CSCL 01C

The effect of aircraft operational techniques in the terminal

area on community noise impact of future short-haul aircraft was studied. One mechanical-flap (MF) aircraft and one externally-blown-flap (EBF) aircraft were used to study the noise impact at four U.S. airports: Hanscom Field (Boston); Washington National; Midway (Chicago); and Orange County (California). The EBF aircraft was the final design E-150-3000 aircraft developed during the NASA STOL Systems Study. With the exception of Washington National (DCA), the study showed that a reduction of approximately 40 percent in the number of people highly annoyed (as defined in the study) can be obtained by using these operational techniques. At DCA the number of people highly annoyed using the standard procedure was quite low, but it is significant that the minimum-impact case for Runway 36 reduced the number of people highly annoyed to zero by using a power cutback and a turning departure path. The evaluation procedures and methodology developed in this study represents an advance in acoustical state-of-the-art and should provide an effective and useful tool for determining aircraft noise impact upon the airport community. Author

N74-31487# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION, ISSUE NO. 5 OF 1973 ACCIDENTS
9 Jul. 1974 353 p
(NTSB-BA-74-3) Avail: NTIS HC $20.75

This publication contains selected aircraft accident reports, in brief format, occurring in U. S. Civil Aviation operations during calendar year 1973. The 538 General Aviation and 14 Air Carrier accidents contained in this publication represent a random selection. This publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N74-31488*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL LOW-SPEED AND CALCULATED HIGH-SPEED AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 65 DEG SWEPT DELTA WING
Jim A. Penland, Theodore R. Creel, Jr., and Floyd G. Howard Washington Aug. 1974 73 p refs
(NASA-TN-D-7633; L-9453) Avail: NTIS HC $3.75 CSCL 01C

An experimental wind-tunnel investigation has been carried out to determine the static longitudinal, lateral, and directional stability and control characteristics of a model of a large-body, delta-wing hypersonic research airplane concept at low speed. This investigation was conducted at a dynamic pressure of 239.4 Pa (5 psf) and a Reynolds number, based on fuselage length, of 2 million. The configuration variables included vertical fins, engine modules, canards, and a canopy. The aerodynamic results of a computer study at Mach numbers of 3 to 12 are presented. Author

N74-31489# Aeronautical Research Inst. of Sweden, Stockholm.
EVALUATION OF THE ACCURACY OF TWO HELICOPTER ROTOR THEORIES
Bo C. A. Johansson 1973 148 p refs Sponsored by Swedish Mater. Admin. of the Armed Forces
(FFA-124) Avail: NTIS HC $10.50

The accuracy of two helicopter rotor or propeller theories by the author (Lifting-line theory for a rotor in vertical climb, FFA Report 118, and Disk approximation for a helicopter rotor in forward flight, FFA Report 123) is examined by comparison with experiments and with different older theories, corresponding to a variety of special applications of the two theories. The accuracy of the first theory is found to be satisfactory. The second theory shows good agreement with other disk approximation theories. It is also found, however, that the use of the disk approximation gives too small induced downwash at the locations of the blades, in particular when the blades are few. Author

N74-31490# Cranfield Inst. of Technology (England).
AIRCRAFT DESIGN STUDIES: E67 TILT-WING EXECUTIVE AIRCRAFT
D. Howe Aug. 1973 54 p refs
(Cranfield-Aero-23) Avail: NTIS HC $5.75

The E67 configuration design is for a vertical take off and landing aircraft for executive use whose vertical flight capability was achieved by using the tilt wing concept. The initial version of the design power provided for two Rolls Royce H1400 Gnome turboshaft engines driving two 16 ft diameter propellers. Cross shaft interconnection between the propellers was included in the layout, although the need for four engines to cater for an engine failure condition in vertical flight became apparent. The pressurized cabin is designed to accommodate up to 18 passengers in a high density feeder role. Conventional design techniques were used throughout. A market survey showed that the design had significant advantages relative either to a helicopter or a twin jet executive type. Author

N74-31491# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
NUMERICAL PREDICTION OF THE PERFORMANCE OF HIGH ALTITUDE BALLOONS
Frank Kreith (Colo. Univ.) and Jan F. Kreider (Colo. Univ.) Feb. 1974 141 p refs
(NCAR-TN/STR-65) Avail: NTIS HC $10.25

A method for predicting the vertical motion of high altitude balloon systems was developed. A calibrated model for predicting the vertical trajectory of zero pressure balloons is discussed. The computer program makes it possible to predict the balloon ascent rates, ceiling, and behavior at float. Author

N74-31492# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
A DYNAMIC ANALYSIS OF AEROPLANES ENCOUNTERING VORTEX WAKE TURBULENCE
R. C. H. Parkinson (Hawker Siddeley Res.) and D. W. Kelly Jan. 1973 52 p refs Sponsored in part by Dept. of Civil Aviation
(ATN-7301) Avail: NTIS HC $5.75

A six degree of freedom flight simulation model was developed for digital computers to investigate the response of aircraft to a pair of trailing vortices. The model was used to simulate the flight of a light, two-seat training aircraft and a twin-engined commercial transport into the vortices shed by medium weight and heavy weight aircraft. Author

N74-31493*# Scientific Translation Service, Santa Barbara, Calif.
PROPELLERS AND HELICOPTER BLADES OF FIBER-REINFORCED SYNTHETIC RESIN MATERIALS
Ulrich Huetter Washington NASA Aug. 1974 27 p refs Transl. into ENGLISH from Jahrbuch 1960 der. WGL (West Ger.), 1960 p 374-381 Presented at 4th European Aerodyn. Congr., Cologne, 18-22 Sep. 1960
(Contract NASw-2483)
(NASA-TT-F-15859) Avail: NTIS HC $4.50 CSCL 01C

Shell structures for propellers and helicopter blades are predominantly under centrifugal loads and therefore essentially subjected to such extensive radial stresses that full advantage can be taken of the high tensile strength of strand-reinforced synthetic resin materials. Great difficulties have been encountered in the past with the diffusion of end loads into fiberglass reinforced compound materials. These difficulties, however, can be overcome by applying the loop method, a method by which the diffusion into various strands is accomplished by means of loops formed by continuous layers of strands. By special treatment of the strands before being placed into the mould, any arbitrary distribution of thickness of the shells can be achieved without using special jigs. The application of various manufacturing techniques to the manufacture of aerofoils in large interval flow engines, propellers and helicopter blades is illustrated. Author

N74-31494*# Scientific Translation Service, Santa Barbara, Calif.
GUST MEASUREMENTS ON CONCORDE
R. Dieudonne Washington NASA Aug. 1974 37 p Transl. into ENGLISH from AAAF 10th Colloq. d'Aerodyn. Appliquee (Lille), 7-9 Nov. 1973 29 p
(Contract NASw-2483)
(NASA-TT-F-15837) Avail: NTIS HC $5.00 CSCL 01C

Scale models of wing, wing and fuselage and complete SST

Concorde models have been tested for gust effects on trajectory, velocity and acceleration for free flight conditions. The trajectory measures 20 chords and the gust is simulated with blowers. Experimental results are compared with calculations of stall conditions and suggestions for improvement are given. Author

N74-31495*# Boeing Commercial Airplane Co., Seattle, Wash.
V/STOL LIFT FAN COMMERCIAL SHORT HAUL TRANSPORTS: CONTINUING CONCEPTUAL DESIGN STUDY
J. M. Zabinsky, W. F. Minkler, J. G. Bohn, T. Derbyshire, J. E. Middlebrooks, J. P. McBarron, B. Williams, and C. W. Miller Washington NASA Jul. 1974 104 p refs
(Contract NAS2-6563)
(NASA-CR-2437; D6-41537) Avail: NTIS HC $4.50 CSCL 01C

A design study of commercial V/STOL transport airplanes for a 1985 operational time period has been made. The baseline mission considered was 400 nmi at a cruise speed of M = 0.75 and a 100-passenger payload with VTOL. Variations from the baseline included mission distance, payload, cruise speed, and propulsion system failure philosophy. All designs used propulsion systems consisting of multiple gas generators driving remote tip turbine lift and lift/cruise fans. By considering the fan to be designed for operational reliability, significant simplication of the airplane systems and reduction in airplane size and cost can be achieved. Author

N74-31496*# Boeing Commercial Airplane Co., Seattle, Wash.
ANALYSIS OF SONIC BOOM MEASUREMENTS NEAR SHOCK WAVE EXTREMITIES FOR FLIGHT NEAR MACH 1.0 AND FOR AIRPLANE ACCELERATIONS Final Report
George T. Haglund and Edward J. Kane Washington NASA Jul. 1974 134 p refs
(Contract NAS1-10992)
(NASA-CR-2417; D6-22547) Avail: NTIS HC $4.75 CSCL 20A

The analysis of the 14 low-altitude transonic flights showed that the prevailing meteorological consideration of the acoustic disturbances below the cutoff altitude during threshold Mach number flight has shown that a theoretical safe altitude appears to be valid over a wide range of meteorological conditions and provides a reasonable estimate of the airplane ground speed reduction to avoid sonic boom noise during threshold Mach number flight. Recent theoretical results for the acoustic pressure waves below the threshold Mach number caustic showed excellent agreement with observations near the caustic, but the predicted overpressure levels were significantly lower than those observed far from the caustic. The analysis of caustics produced by inadvertent low-magnitude accelerations during flight at Mach numbers slightly greater than the threshold Mach number showed that folds and associated caustics were produced by slight changes in the airplane ground speed. These caustic intensities ranged from 1 to 3 time the nominal steady, level flight intensity.
Author

N74-31497*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SONIC-BOOM GROUND PRESSURE MEASUREMENTS FROM THE LAUNCH AND REENTRY OF APOLLO 16
Herbert R. Henderson and David A. Hilton Washington Aug. 1974 45 p refs
(NASA-TN-D-7606; L-9394) Avail: NTIS HC $3.25 CSCL 04A

Sonic-boom pressure signatures recorded during the launch and reentry phases of the Apollo 16 mission are presented. Five measurements were obtained along the vehicle ground track: 69 km (37.3 n. mi.) 92 km (49.8 n. mi.), and 130 km (70.3 n. mi.) down range from the launch site during ascent, and at 185 km (100 n. mi.) and approximately 5.5 km (3 n. mi.) from the splash-down point during reentry. Tracings of the measured signatures are included along with values of the overpressure, impulse, time duration, and rise times. Also included are brief descriptions of the launch and recovery test areas in which the measurements were obtained, the sonic-boom instrumentation deployment, flight profiles, and operating conditions for the launch vehicle and spacecraft, surface weather information at the measuring sites, and high-altitude weather information for the general measurement areas. Comparisons of the sonic-boom overpressures from Apollo 15 and 16 along with those from current aircraft are also presented. Author

N74-31498*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYTICAL MODEL FOR TILTING PROPROTOR AIRCRAFT DYNAMICS, INCLUDING BLADE TORSION AND COUPLED BENDING MODES, AND CONVERSION MODE OPERATION
Wayne Johnson Aug. 1974 160 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62369) Avail: NTIS HC $5.00 CSCL 01C

An analytical model is developed for proprotor aircraft dynamics. The rotor model includes coupled flap-lag bending modes, and blade torsion degrees of freedom. The rotor aerodynamic model is generally valid for high and low inflow, and for axial and nonaxial flight. For the rotor support, a cantilever wing is considered; incorporation of a more general support with this rotor model will be a straight-forward matter. Author

N74-31499*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS IN AIRCRAFT DESIGN SINCE 1903
1974 97 p
(NASA-TM-X-70319; L-9866) Avail: NTIS HC $8.00 CSCL 01C

Significant developments in aviation history are documented to show the advancements in aircraft design which have taken place since 1903. Each aircraft is identified according to the manufacturer, powerplant, dimensions, normal weight, and typical performance. A narrative summary of the major accomplishments of the aircraft is provided. Photographs of each aircraft are included. Author

N74-31500*# Systems Technology, Inc., Hawthorne, Calif.
ANALYSIS OF VORTEX WAKE ENCOUNTER UPSETS Final Report
Walter A. Johnson and Gary L. Teper Aug. 1974 90 p refs
(Contract NAS4-1952)
(NASA-CR-127491; TR-1025-2) Avail: NTIS HC $7.50 CSCL 01C

The problem of an airplane being upset by encountering the vortex wake of a large transport on takeoff or landing is currently receiving considerable attention. This report describes the technique and results of a study to assess the effectiveness of automatic control systems in alleviating vortex wake upsets. A six-degree-of-freedom nonlinear digital simulation was used for this purpose. The analysis included establishing the disturbance input due to penetrating a vortex wake from an arbitrary position and angle. Simulations were computed for both a general aviation airplane and a commercial jet transport. Dynamic responses were obtained for the penetrating aircraft with no augmentation, and with various command augmentation systems, as well as with human pilot control. The results of this preliminary study indicate that attitude command augmentation systems can provide significant alleviation of vortex wake upsets; and can do it better than a human pilot. Author

N74-31501*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERTURBATION SOLUTIONS FOR THE INFLUENCE OF FORWARD FLIGHT ON HELICOPTER ROTOR FLAPPING STABILITY
Wayne Johnson Aug. 1974 109 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62361) Avail: NTIS HC $8.50 CSCL 01C

The stability of the flapping motion of a helicopter rotor blade in forward flight is investigated, using a perturbation technique which gives analytic expressions for the eigenvalues, including the influence of the periodic aerodynamic forces in forward flight. The perturbation solutions are based on small advance ratio (the ratio of the helicopter forward speed to the rotor tip speed). The rotor configurations considered are a single, independent blade; a teetering rotor; a gimballed rotor with three, four, and five or more blades; and a rotor with N independent blades. The constant coefficient approximation with the equations and degrees of freedom in the nonrotating frame represents the flap dynamic reasonably well for the lower frequency modes.

although it cannot, of course, be completely correct. The transfer function of the rotor flap response to sinusoidal pitch input is examined, as an alternative to the eigenvalues as a representation of the dynamic characteristics of the flap motion. Author

N74-31502*# Kanner (Leo) Associates, Redwood City, Calif.
NOISE MEASUREMENT OF THE JET AND PISTON ENGINES ON THE LALA-1 EXPERIMENTAL AIRPLANE
A. Rudiuk Washington NASA Sep. 1974 8 p Transl. into English from Tech. Lotnicza Astronaut. (Poland), v. 29, Feb. 1974 p 15-17
(Contract NASw-2481)
(NASA-TT-F-15885) Avail: NTIS HC $4.00 CSCL 20A

Results of noise measurements conducted on the ground and in the cabin of an experimental agricultural biplane Lala-1 during operation of either a jet engine or a piston engine on the aircraft. The locations and mounting of the two engines differed, and the measurements served not for purposes of strict comparison but as a basis of evaluating noise reduction possibilities offered by a jet engine. Isosonic curves and curves of amplitude vs. frequency (31.5 Hz to 31.5 kHz) are illustrated for both engines. Author

N74-31503*# Scientific Translation Service, Santa Barbara, Calif.
AIRCRAFT NOISE IN RESIDENTIAL AREAS: MEASUREMENT AND EVALUATION
H.-O. Finke and R. Martin Washington NASA Aug. 1974 19 p refs Transl. into ENGLISH of "Fluglaerm in Wohngebieten: Messung und Beurteilung", Paper DGLR-74-013 Deutsche Gesellschaft fuer Luft-und Raumfahrt, 1974 p 1-8 Presented at Symp. ueber Triebwerkslaerm, Braunschweig, West Germany, 20-21 Feb. 1974
(Contract NASw-2483)
(NASA-TT-F-15907; DGLR-74-013) Avail: NTIS HC $4.00 CSCL 20A

Acoustical measurements and evaluations of aircraft noise were carried out by a team of university personnel in West Germany in the fields of acoustics, medicine, psychology, social sciences and occupational psychology. The Munich, West Germany airport was investigated in 1969. Inhabitants near the airport were tested by means of questionnaires, which were statistically evaluated. Author

N74-31504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BONDED COMPOSITE TO METAL SCARF JOINT PERFORMANCE IN AN AIRCRAFT LANDING GEAR DRAG STRUT
William E. Howell Jul. 1974 25 p refs Presented at Army Symp. on Solid Mech., 1974, the Role of Mech. in Design - Structural Joints, Cape Cod, Maine, 10-12 Sep. 1974
(NASA-TM-X-71995) Avail: NTIS HC $3.00 CSCL 01C

The structural performance of a boron-epoxy reinforced titanium drag strut, which contains a bonded scarf joint and was designed to the criteria of the Boeing 747 transport, was evaluated. An experimental and analytical investigation was conducted. The strut was exposed to two lifetimes of spectrum loading and was statically loaded to the tensile and compressive design ultimate loads. Throughout the test program no evidence of any damage in the drag strut was detected by strain gage measurements, ultrasonic inspection, or visual observation. An analytical study of the bonded joint was made using the NASA structural analysis computer program NASTRAN. A comparison of the strains predicted by the NASTRAN computer program with the experimentally determined values shows excellent agreement. The NASTRAN computer program is a viable tool for studying, in detail, the stresses and strains induced in a bonded joint. Author

N74-31505*# Boeing Commercial Airplane Co., Seattle, Wash.
HIGH-TRANSONIC-SPEED TRANSPORT AIRCRAFT STUDY Summary Report
Robert M. Kulfan Washington NASA Sep. 1974 27 p refs
(Contract NAS2-7031)
(NASA-CR-2465; D6-60231) Avail: NTIS HC $3.25 CSCL 01C

An initial design study of high-transonic-speed transport aircraft has been completed. Five different design concepts were developed. These included fixed swept wing, variable-sweep wing, delta wing, double-fuselage yawed-wing, and single-fuselage yawed-wing aircraft. The boomless supersonic design objectives of range = 5560 km (3000 nmi), payload = 18,143 kg (40,000 lb), Mach = 1.2, and FAR Part 36 aircraft noise levels were achieved by the single-fuselage yawed-wing configuration with a gross weight of 211,828 kg (467,000 lb). A noise level of 15 EPNdB below FAR Part 36 requirements was obtained with a gross weight increase to 226,796 kg (500,000 lb). The off-design subsonic range capability for this configuration exceeded the Mach 1.2 design range by more than 20%. Although wing aeroelastic divergence was a primary design consideration for the yawed-wing concepts, the graphite-epoxy wings of this study were designed by critical gust and maneuver loads rather than by divergence requirements. The transonic nacelle drag is shown to be very sensitive to the nacelle installation. A six-degree-of-freedom dynamic stability analysis indicated that the control coordination and stability augmentation system would require more development than for a symmetrical airplane but is entirely feasible. A three-plane development plan is recommended to establish the full potential of the yawed-wing concept.
Author

N74-31506*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION TO DETERMINE THE LOW SPEED YAWING STABILITY DERIVATIVES OF A TWIN JET FIGHTER MODEL AT HIGH ANGLES OF ATTACK
Paul L. Coe, Jr. and William A. Newsom, Jr. Washington Aug. 1974 41 p refs
(NASA-TN-D-7721; L-9664) Avail: NTIS HC $3.25 CSCL 01C

An investigation was conducted to determine the low-speed yawing stability derivatives of a twin-jet fighter airplane model at high angles of attack. Tests were performed in a low-speed tunnel utilizing variable-curvature walls to simulate pure yawing motion. The results of the study showed that at angles of attack below the stall the yawing derivatives were essentially independent of the yawing velocity and sideslip angle. However, at angles of attack above the stall some nonlinear variations were present and the derivatives were strongly dependent upon sideslip angle. The results also showed that the rolling moment due to yawing was primarily due to the wing-fuselage combination, and that at angles of attack below the stall both the vertical and horizontal tails produced significant contributions to the damping in yaw. Additionally, the tests showed that the use of the forced-oscillation data to represent the yawing stability derivatives is questionable, at high angles of attack, due to large effects arising from the acceleration in sideslip derivatives. Author

N74-31507*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATOR STUDY OF MINIMUM ACCEPTABLE LEVEL OF LONGITUDINAL STABILITY FOR A REPRESENTATIVE STOL CONFIGURATION DURING LANDING APPROACH
William D. Grantham and Perry L. Deal Washington Sep. 1974 37 p refs
(NASA-TN-D-7733; L-9690) Avail: NTIS HC $3.25 CSCL 01C

A fixed-base simulator study was conducted to determine the minimum acceptable level of longitudinal stability for a representative turbofan STOL (short take-off and landing) transport airplane during the landing approach. Real-time digital simulation techniques were used. The computer was programed with equations of motion for six degrees of freedom, and the aerodynamic inputs were based on measured wind-tunnel data. The primary piloting task was an instrument approach to a breakout at a 60-m (200-ft) ceiling. Author

N74-31508# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugzeugbau und Leichtbau.
APPLICABILITY OF CARBON FIBERS IN HEAVILY STRESSED AIRCRAFT COMPONENTS [UNTERSUCHUNGEN UEBER DIE ANWENDUNG VON KOHLENSTOFFFASERN IN HOCHBEANSPRUCHTEN FLUGZEUGBAUTEILEN]
D. Muehlhahn, H. Treiber, and W. Mischke Bonn Bundeswehramt 1973 109 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Der Verteidigung

(BMVg-FBWT-73-39) Avail: NTIS HC $8.50; Bundeswehramt 54 DM

The feasibility of using carbon fiber reinforced plastics (CRP) for primary wing structures of aircraft was investigated. Strength and stiffness of CRP were determined with regard to application in wing spars and torsion boxes. Production methods for glass fiber reinforced plastic composites were extended to CRP structures and the experience gained was applied to the fabrication of the inner CRP wing part of the SB-10 glider. The investigations have shown that strength and fabrication problems of primary glider structures, using (CRP) composites, can be overcome. ESRO

N74-31509# Royal Aircraft Establishment, Farnborough (England).

THE RESPONSE OF SOME LEADED WINDOWS TO SIMULATED SONIC BANGS

R. J. Pallant Nov. 1973 51 p refs

(RAE-TR-73111; BR37827) Avail: NTIS HC $5.75

The behavior of lead framework, or calmes, was studied in leaded-light windows due to repeated loadings by simulated sonic bangs of moderate amplitude. The threshold at which damage occurs was also assessed. How the tests were carried out is described and results of the measurements taken are given. The results indicate that some small permanent deflection of leaded lights may occur if they are subjected to real sonic bangs over a long period. Characteristic overpressures greater by a factor of 20 than those predicted for commercial supersonic transport aircraft in the cruise will be required to produce even a first indication of damage. Author (ESRO)

N74-31510# Royal Aircraft Establishment, Farnborough (England).

RANGE PERFORMANCE IN CRUISING FLIGHT

D. H. Peckham Mar. 1974 58 p refs

(RAE-TR-73164; BR40126) Avail: NTIS HC $6.00

The classical theory of range performance is reviewed, and some further relationships derived. The specific range, which is the instantaneous range performance of an aircraft at a point on a cruise trajectory, in terms of distance covered per unit quantity of fuel consumed is considered. The integration of specific range over a given flight trajectory, to give the integral range on a given quantity of fuel is also discussed, and comparisons are made between the ranges obtained using various cruising techniques. Author (ESRO)

N74-31511# Calspan Corp., Buffalo, N.Y.

IDENTIFICATION AND CORRELATION OF THE F-4E STALL/POST-STALL AERODYNAMIC STABILITY AND CONTROL CHARACTERISTICS FROM EXISTING TEST DATA Final Report, Mar. 1972 - Jun. 1973

Bernard J. Eulrich and Norman C. Weingarten Aug. 1973 345 p refs

(Contract F33615-72-C-1248; AF Proj. 8219)

(AD-779928; CALSPAN-AK-5126-F1; AFFDL-TR-73-125) Avail: NTIS CSCL 01/3

The report documents the results of a study performed for the United States Air Force Flight Dynamics Laboratory to identify the high angle of attack post stall aerodynamic stability and control characteristics of the F-4 aircraft from existing full scale and radio-controlled drop model test data and to correlate these results with similar characteristics obtained from wind tunnel tests. A parameter identification procedure was set up to extract these nonlinear characteristics from flight test records using a nonlinear iterated Kalman filter/fixed-point smoother algorithm and a least square equation error method. Model form is established from wind tunnel data by representing the aerodynamic coefficients by Taylor's series expansions for selected ranges of angle of attack. (Modified author abstract) GRA

N74-31512# Army Aviation Systems Test Activity, Edwards AFB, Calif.

FLIGHT EVALUATION: PACER SYSTEMS, INCORPORATED, LORAS 2 AIRSPEED SYSTEM Final Report, 29 Jan. - 5 Jul. 1973

Barclay H. Boirun, Floyd Dominick, James S. Kishi, Robert K. Merrill, and John R. Smith Mar. 1974 65 p refs

(AD-780018; USAASTA-71-30-3; FR-3) Avail: NTIS CSCL 01/4

Airspeed calibration tests were conducted on the Pacer Systems, Inc. LORAS II low-range airspeed system to determine its suitability for use as a helicopter airspeed instrument. Testing was conducted by the United States Army Aviation Systems Test Activity at Edwards Air Force Base, California between 29 January and 5 July 1973. The evaluation required 17.2 productive flight test hours. (Modified author abstract) GRA

N74-31513# Army Aviation Systems Test Activity, Edwards AFB, Calif.

INSTRUMENT FLIGHT EVALUATION OH-6A HELICOPTER, PART 1 Final Report, Feb. 1972 - Aug. 1973

Albert L. Winn, Warren E. Griffith, II, and Carl F. Mittag Nov. 1973 81 p refs

(AD-780016; USAASTA-72-06) Avail: NTIS CSCL 01/3

A limited flying qualities and operational performance evaluation was conducted on the OH-6A helicopter to determine the suitability for operation under instrument flight conditions. The operational evaluation was performed with and without a Kaiser FP-508 flight director system installed. Tests were conducted at the United States Army Aviation Systems Test Activity, Edwards Air Force Base, California, during the period from February 1972 to August 1973. (Modified author abstract) GRA

N74-31514# Notre Dame Univ., Ind.

PERFORMANCE ESTIMATES FOR POWERED PARAFOIL SYSTEMS Final Report

John D. Nicolaides Feb. 1974 67 p refs

(Contract F33615-71-C-1093; AF Proj. 6065)

(AD-779926; AFFDL-TR-74-12) Avail: NTIS CSCL 01/3

The estimated flight performance of powered parafoil systems are presented for various system weights ranging from 10 pounds to 10,000 pounds. Special attention is given to level flight, climbing and descending flight, and take-off distance. The equations of motion are summarized and the effect of the thrust pitch angle is evaluated. Various system designs such as manned flight, cargo and weapon delivery, and decoy and jammer vehicles are considered as examples for using the performance curves and equations. Author (GRA)

N74-31515# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

CONTINUOUS SEAM DIFFUSION BOND TITANIUM SPAR EVALUATION Final Report, 20 Jun. 1972 - 20 Jan. 1974

Maron J. Bonassar and John J. Lucas Apr. 1974 73 p

(Contract DAAG46-72-C-0175)

(AD-780029; AMMRC-CTR-74-37) Avail: NTIS CSCL 01/3

The objectives of this program were establishment of a technology to fabricate helicopter titanium main rotor blade spars cut from sheet material and joined by continuous seam diffusion bonding (CSDB) and the eventual application of this technology in the manufacturing of various components at reduced overall cost. The effects of different thermal treatments after bonding were determined by tensile and fatigue testing of small test specimens fabricated from titanium sheet flat panels joined by CSDB. Three 9-foot long spar sections were then fabricated, and two were tested in fatigue. The results indicate that continuous seam diffusion bonding has fatigue strength characteristics as good as, or better than, present fusion welded main rotor blade spar specimens and should be further evaluated for this application. (Modified author abstract) GRA

N74-31516# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

AN EXPERIMENTAL AND ANALYTICAL STUDY OF SPECTRUM TRUNCATION EFFECTS

J. M. Potter Feb. 1974 27 p refs

(AD-778488; AFFDL-TR-73-117) Avail: NTIS CSCL 01/3

The report presents the results and analysis of a series of tests designed to investigate the effects of load cycle truncation in a flight-by-flight sequence loading. Conventional damage analyses were used to determine the load cycles that could be eliminated without significantly changing the structural life when compared to the full spectrum. A newly developed cumulative damage analysis, the Sequence Accountable Fatigue

Analysis, was used to make independent predictions of the truncation. GRA

N74-31517# Boeing Vertol Co., Philadelphia, Pa.
ROTOR BLADE TREATMENTS TO MINIMIZE ELECTROSTATICALLY GENERATED NOISE ON THE HLH HELICOPTER
R. DeRosa and J. Solak 1 May 1974 68 p refs
(Contract DAAJ01-73-A-0017)
(AD-780720; D301-10279-1) Avail: NTIS CSCL 01/3

A laboratory investigation was undertaken to evaluate the severity of precipitation-static noise to be expected on the Heavy Lift Helicopter (HLH) low-frequency systems, and to define the requirements of techniques for noise elimination on the HLH. This investigation, using a 1/25th scale model of the HLH and actual proposed rotor-blade panel samples revealed the need for RFI protection on the HLH. Recommendations were made to install P-static dischargers on the HLH rotor blades, and the optimum number and location of these dischargers was discussed. Noise reduction afforded by various rotor-blade-coating systems was also investigated and reported. A recommendation was made for a particular coating system, based on noise-reduction and surface-resistivity measurements. Author (GRA)

N74-31518# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
HELICOPTER DOWNWASH DATA
Grady W. Leese and John T. Knight, Jr. Jun. 1974 49 p
(DA Proj. 1T0-62013-A-046)
(AD-780754; AEWES-Misc-Paper-S-74-17) Avail: NTIS CSCL 01/3

The report describes an investigation involving measurement of horizontal velocities, along and up to six feet above the ground surface, generated by the rotor systems of various Army helicopters during takeoff, hover, and fly-by operations. Measurements of ground-wash velocities during various operational modes were collected for OH-58A, OH-6A, AH-1G, UH-1H, UH-1M, CH-47, and CH-54 helicopters. (Modified author abstract) GRA

N74-31519# Adaptronics, Inc., McLean, Va.
COMPUTER SIMULATION OF RPV FLIGHT CHARACTERISTICS Final Technical Report, 1 Jan. - 29 Sep. 1973
Dixon Cleveland, Roger L. Barron, and Milford R. Derrick Mar. 1974 86 p refs
(Contract F33615-73-C-4055)
(AD-781079; AMRL-TR-73-119; Rept-676-FTR) Avail: NTIS CSCL 01/3

The report presents a set of equations of motion for remotely piloted vehicles. The equations are written in a form suitable for a real-time digital computer simulation. The simulation is intended to provide a test bed for evaluating alternative RPV control systems. A FORTRAN program for use on a Digital Equipment Corporation PDP-12 Computer is presented. Airframe parameter values are given for several flight conditions of an air-to-ground RPV, an air-to-air RPV and, a reconnaissance/EW RPV. Author (GRA)

N74-31520# RAND Corp., Santa Monica, Calif.
EXAMPLES OF AIRCRAFT SCHEDULED-MAINTENANCE ANALYSIS PROBLEMS
Marsha Dade Dec. 1973 57 p refs
(Contract F44620-73-C-0011)
(AD-781141; R-1299-PR) Avail: NTIS CSCL 01/3

A description is given of several statistical analyses of aircraft scheduled maintenance data illustrating the kinds of errors that might occur through the use of packaged computer programs and procedures by non-specialists. The analyses are grouped to illustrate three potential sources of analytical error; alternative causes for observed phenomena, variations in sample size, and failure to compensate for extraneous effects. (Modified author abstract) GRA

N74-31521# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
PROPOSED QF-4B SUPPLEMENT TO THE F-4B NATOPS FLIGHT MANUAL (NAVAIR 01-245FDB-1)
William G. Seeman, Jr. 31 Dec. 1973 124 p refs
(AD-780773; NADC-73219-30) Avail: NTIS CSCL 01/3

The report presents a general description of, and operating procedures for, the QF-4B target aircraft. It is intended to supplement the existing F-4B NATOPS Flight Manual. Consequently, the report is written with the presumption that the reader is familiar with the F-4B NATOPS Flight Manual. Author (GRA)

N74-31522# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
NAVAIRDEVCEN GRAPHITE-EPOXY COMPOSITE WING FOR BQM-34E: STATIC TEST RESULTS Final Report
Mark Libeskind, Joseph Minecci, S. L. Huang, and Edward J. McQuillen 3 Dec. 1973 30 p refs
(AD-780774; NADC-73244-30) Avail: NTIS CSCL 01/3

A graphite-epoxy composite wing for the BQM-34E unmanned supersonic aerial target vehicle has been successfully static tested to 100% design limit load at the NAVAIRDEVCEN. Author (GRA)

N74-31523# Army Air Mobility Research and Development Lab., Fort Eustis, Va. Eustis Directorate.
INCENDIARY GUNFIRE EVALUATION OF A CONDENSATE-FORMED FUEL FOG INERTING SYSTEM
Charles M. Pedriani May 1974 13 p refs
(DA Proj. 1F2-62205-AH-88)
(AD-780837; USAAMRDL-TN-15) Avail: NTIS CSCL 01/3

Army aircraft are vulnerable to catastrophic fuel tank explosions from incendiary impact in the ullage. Previous testing indicated that aircraft fuel tank inerting concepts that create overrich ullage atmospheres should have a high probability of success. Nevertheless, initial attempts to design such a system using fuel fog techniques met with failure. Subsequently, a unique condensate-formed fuel fog system was tested under Contract DAAJ02-73-C-0087 and found to be effective in preventing ullage explosions caused by an electric match. After completion of the contract, the system was tested further and found to be ineffective in preventing fires initiated by an incendiary gunfire simulator. (Modified author abstract) GRA

N74-31524# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
AERODYNAMIC AND DYNAMIC PROBLEMS RELATING TO HEAVY-LIFT HELICOPTERS Final Report, 1 Sep. 1970 - 23 Feb. 1974
Barnes W. McCormick 6 May 1974 20 p refs
(Grants DA-ARO(D)-31-124-73-G13;
DA-ARO(D)-31-124-73-G36)
(AD-780973; PSU-AERSP-74-3; AROD-9334-4-E) Avail: NTIS CSCL 01/3

The report is descriptive in nature. For specifics of the technical accomplishment achieved under these grants, the reader is referred to the four theses by Potter, Rudy, Egolf and Pepin listed in the references. The first three of these theses have been completed and were prepared in partial fulfillment of the requirements for the Master of Science degree. Pepin's thesis is a Ph.D. dissertation which could not be completed before the expiration of the grant. It is currently being written and should be available shortly. All of these studies are generally related to helicopter applications although the specific motivation for their undertaking was initially the heavy-lift helicopter. The remainder of this report summarizes the findings of these investigators. (Modified author abstract) GRA

N74-31525# A.Q.D. Labs., Harefield (England).
ENDURANCE TEST ON FLEXIBLE STEEL WIRE ROPE FOR AIRCRAFT CONTROLS AT VARIOUS PULLEY/ROPE DIAMETER RATIOS
H. A. Senior and A. New 1974 19 p
(AD-780570; AQD1D14; BR39988) Avail: NTIS CSCL 01/3

During previous investigations into the endurance properties of flexible steel wire rope for aircraft controls, large losses in strength were noted when small test pulleys were used. In view of this, a program of tests has been carried out to investigate the effects of test pulley size on the endurance of 1/8 inch diameter carbon and corrosion resistant steel ropes. A range of test pulley/rope diameter ratios between 7 and 30 has been investigated and the results of these tests are given in the report. The indications are that pulley to rope ratios of the order of 20

to 1 are desirable to ensure good endurance properties. The report also shows that under the particular conditions of test used (ie room temperature) corrosion resistant steel showed the better endurance properties. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-31526*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED RANKINE AND BRAYTON CYCLE POWER SYSTEMS: MATERIALS NEEDS AND OPPORTUNITIES
S. J. Grisaffe and D. C. Guentert 1974 27 p refs Presented at the Mater. for Power Systems Meeting, Seven Springs, Penn., 17-19 Jun. 1974; sponsored by the American Society for Metals
(NASA-TM-X-71583; E-8035) Avail: NTIS HC $3.25 CSCL 10A

Conceptual advanced potassium Rankine and closed Brayton power conversion cycles offer the potential for improved efficiency over steam systems through higher operating temperatures. However, for utility service of at least 100,000 hours, materials technology advances will be needed for such high temperature systems. Improved alloys and surface protection must be developed and demonstrated to resist coal combustion gases as well as potassium corrosion or helium surface degradation at high temperatures. Extensions in fabrication technology are necessary to produce large components of high temperature alloys. Long time property data must be obtained under environments of interest to assure high component reliability. Author

N74-31527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY DESIGN OF A 100 kW TURBINE GENERATOR
Richard L. Puthoff and Paul J. Sirocky 1974 22 p refs Presented at Intern. Solar Energy Soc., Ft. Collins, Colo., 21-23 Aug. 1974
(NASA-TM-X-71585; E-8037) Avail: NTIS HC $3.00 CSCL 10A

The National Science Foundation and the Lewis Research Center have engaged jointly in a Wind Energy Program which includes the design and erection of a 100 kW wind turbine generator. The machine consists primarily of a rotor turbine, transmission, shaft, alternator, and tower. The rotor, measuring 125 feet in diameter and consisting of two variable pitch blades operates at 40 rpm and generates 100 kW of electrical power at 18 mph wind velocity. The entire assembly is placed on top of a tower 100 feet above ground level. Author

N74-31528# Joint Publications Research Service, Arlington, Va.
DIMENSIONAL ANALYSIS OF BIOENERGETIC VALUES
A. A. Dyuldin 31 Jul. 1974 14 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (Moscow), no. 3, 1974 p 386-393
(JPRS-62608) Avail: NTIS HC $4.00

The dimensions of outputs of energy fluxes, their intensities, and quadratic indices of outputs, are studied. Author

N74-31529# Mitre Corp., McLean, Va.
RECOMMENDATIONS TO RANN/NSF: SOLAR ENERGY R AND T PROGRAM
Richard S. Greeley, comp. Feb. 1974 84 p
(M74-21) Avail: NTIS HC $7.25

A systems analysis of solar energy programs was conducted and a summary of the results is provided. Briefly, various solar energy applications and techniques are expected to become economically competitive with conventionally fueled systems between 1985 and 2000 and could provide significant quantities of energy to the U. S. early in the 21st Century. The problems associated with each of seven solar energy applications and techniques are identified and details of proof-of-concept experiments in each area are outlined. Recommended methods for the dissemination and utilization of research results are listed. Author

N74-31530*# Naval Ammunition Depot, Crane, Ind. Weapons Quality Engineering Center.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY STANDARD AND TEFLONATED NEGATIVE ELECTRODE 20.0 AMPERE-HOUR, NICKEL-CADMIUM SPACECRAFT CELLS WITH AUXILIARY ELECTRODES
1 Jul. 1974 28 p
(NASA Order S-23404-G)
(NASA-CR-139654; WQEC/C-74-337) Avail: NTIS HC $4.50 CSCL 10A

The standard plate cells exhibited higher average end-of-charge (EOC) voltages than the cells with teflonated negative plates; they also delivered a higher capacity output in ampere hours following these charges. All the cells reached a pressure of 20 psia before reaching the voltage limit of 1.550 volts during the pressure versus capacity test. The average ampere hours in and voltages at this pressure were 33.6 and 1.505 volts respectively for the teflonated negative plate cells and 35.5 and 1.523 volts for the standard plate cells. All cells exhibited pressure decay in the range of 1 to 7 psia during the last 30 minutes of the 1-hour open circuit stand. Average capacity out for the teflonated and standard negative plate cells was 29.4 and 29.9 ampere hours respectively. Author

N74-31531*# Techtran Corp., Glen Burnie, Md.
ARE WIND-DRIVEN POWER PLANTS POSSIBLE?
P. Juchem Washington NASA Aug. 1974 10 p Transl. into ENGLISH from Koelnische Rundschau (West Ger.), no. 96a, 26 Apr. 1953
(Contract NASw-2485)
(NASA-TT-F-15860) Avail: NTIS HC $4.00 CSCL 10A

A great deal has been written about the project to exploit wind energy to produce electrical energy. The controversy over the tremendous wind wheels has not died down, and, in the age of an evergrowing demand for energy, it has again become a subject of discussion. The following is a contribution to this subject and reflects the personal opinion of the author about the project. Author

N74-31532*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
THE DEVELOPMENT OF A SOLAR POWERED RESIDENTIAL HEATING AND COOLING SYSTEM Final Report
Mark J. ONeill, Paul O. McCormick, and William R. Kruse Jul. 1974 95 p refs
(Contract NAS8-25986)
(NASA-CR-120400; LMSC-HREC-TR-D390138) Avail: NTIS HC $7.75 CSCL 10A

A solar energy collector design is disclosed that would be efficient for both energy transfer and fluid flow, based upon extensive parametric analyses. Thermal design requirements are generated for the energy storage systems which utilizes sensible heat storage in water. Properly size system components (including the collector and storage) and a practical, efficient total system configuration are determined by means of computer simulation of system performance. Author

N74-31533*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
ADVANCED AVIONICS BREADBOARD EXECUTIVE DESIGN AND IMPLEMENTATION
L. R. Adams 1972 27 p
(Contract NAS8-14000)
(NASA-CR-120416; IBM-72W-00413) Avail: NTIS HC $4.50 CSCL 01C

The advanced avionics breadboard (AAB) executive evolved from an effort to design and develop an avionics system. This executive is unique in that it supervises a triple redundant avionics computer system. Three IBM System 4 Pi/CP computers, operating synchronously and executing identical software, comprise the central processors which route data to and from a

data bus via an input/output controller. The executive's basic function is to provide application programs with an efficient software structure within which to perform specific avionics application tasks. Although implemented in a triplex data management system, the AAB executive contains the flexibility to be adapted to other systems with minimal change. Author

N74-31534*# Techtran Corp., Glen Burnie, Md.
WIND POWER USAGE IN EUROPE?
A. T. H. Gross Washington NASA Aug. 1974 19 p refs Transl. into ENGLISH from Ergeb. der Jahrestagung der Studienges. Windkraft eV Stuttgart, DK 621.311.24.003.1, no. 4 p 1-6
(Contract NASw-2485)
(NASA-TT-F-15855) Avail: NTIS HC $4.00 CSCL 10A

The development of wind power technology has lead to basic discoveries which will make standardized large-scale production possible. Its economical use is regarded as a possible extra source of electrical energy for already existing systems, since there is an abundance of wind in the plains stretches of Central Europe. Equipment cost for system-sized, self regulating wind power machines which now produce a respectable 100 to 300 kilowatts, are estimated at about 600 to 700 marks per kilowatt in large-scale production. In those areas which still have no electricity, underdeveloped countries for instance, an individual wind machine could well compete with the diesel engine.
Author

N74-31535*# Scientific Translation Service, Santa Barbara, Calif.
UTILIZATION OF WIND ENERGY IN DENMARK
Washington NASA Sep. 1974 16 p ref Transl. into ENGLISH from Tech. Mod. (France), v. 35, no. 13-14, 1-15 Jul. 1943 p 106-109
(Contract NASw-2483)
(NASA-TT-F-15868) Avail: NTIS HC $4.00 CSCL 10A

Use of wind energy in Denmark during World Wars 1 and 2 is reviewed. It presents statistical data on other energy sources and compares costs of all types of energy. Some technical discussion of the Lykkegaard 5.5 m diameter mills and F.L.S. 17.5 m diameter mills is given. Author

N74-31536*# Scientific Translation Service, Santa Barbara, Calif.
TERRESTRIAL APPLICATIONS OF THE PHOTOVOLTAIC SOLAR GENERATORS
Washington NASA Sep. 1974 83 p Transl. into ENGLISH of "Les Applications Terrestres des Generateurs Solaires Photovoltaiques", Centre National d'Etude Spatiales, Paris, report, 1974 p 1-78
(Contract NASw-2483)
(NASA-TT-F-15906) Avail: NTIS HC $7.25 CSCL 10A

The future prospects of solar generators are discussed. An analysis is made of the present state of the application of photovoltaic energy. The future prospects in France and other countries are discussed, followed by three supplements covering hydrogen storage of electric power produced by solar cells and the climatology of solar radiation. Author

N74-31537# California Univ., Livermore. Lawrence Livermore Lab.
SHALLOW SOLAR POND ENERGY CONVERSION SYSTEM: AN ANALYSIS OF A CONCEPTUAL 10-MWe PLANT
A. F. Clark, J. A. Day, W. C. Dickinson, and L. F. Wouters 25 Jan. 1974 30 p refs
(Contract W-7405-eng-48)
(UCRL-51533) Avail: NTIS HC $4.00

A shallow solar pond system appears to be the most cost effective way to produce large scale electric power from solar energy. Water is used both for heat collection and heat storage. Inexpensive layers of weatherable transparent plastic over the water suppress heat loss to the environment. The hot water is stored in an insulated reservoir at night and during bad weather. The stored hot water heats a thermodynamic fluid, such as Freon 11, which drives a turbine and an electric generator. The estimated busbar cost of electricity (in 1973 dollars) for a shallow solar pond system, which could come on line in as short a time as 5 to 7 years, is 27 mills/kWh. It is projected that this cost could be reduced by almost half with the development of improved and cheaper plastics and more efficient turbines. Author (NSA)

N74-31538# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
MANUFACTURING AND TESTING OF A HYDRAZINE GAS GENERATOR FOR ATTITUDE CONTROL OF SPACECRAFTS, VOLUME 1 Final Report
Manfred Steenborg Nov. 1973 150 p refs
(Contract ESTEC-1502-HP)
(ESRO-CR(P)-460) Avail: NTIS HC $10.50

The general purpose and function of a hydrazine gas generator for use in spacecraft attitude control are outlined and a synopsis of the requirements is given. The gas generator assembly design is discussed in detail and performance tests and inspections described. Modifications to the generator are also presented. ESRO

N74-31539# Naval Research Lab., Washington, D.C.
ENERGY FROM THE OCEAN: AN APPRAISAL
Owen M. Griffin May 1974 47 p refs
(NRL Proj. F02-24; RR1310341)
(AD-779877; NRL-MR-2803) Avail: NTIS CSCL 10/1

The oceans and their environment have long been envisioned as renewable sources of energy. It is the purpose of this report to assess the feasibility of drawing on the sea for power and to determine the extent to which the oceans are likely to serve future energy needs. A review is made of proposed U.S. funding levels for the research and development of renewable energy sources during the years 1975 - 1979, and a study is made of the technical and environmental acceptability status of tidal, wind, and sea thermal power generation systems. The estimated costs of these environmental power sources are compared with the prevailing power costs for nuclear and coal plants. On the basis of these comparisons, recommendations are made for a program of research and development, culminating in the construction of prototype plants, for wind and sea thermal power plants. Tidal power generation is found to be technically feasible but economically uninviting at present. Author (GRA)

N74-31540# Logistics Management Inst., Washington, D.C.
ECONOMIC FEASIBILITY OF STANDARDIZED AVIONICS
May 1974 105 p
(Contract SD-321)
(AD-780797; LMI-73-12) Avail: NTIS CSCL 01/3

The study examines some of the economic implications of using standard avionics. It uses case studies of radar altimeters and inertial navigation systems to identify the major elements of life cycle cost that might be affected by standardization and to estimate the order of magnitude of possible savings. Also included are the major risks of standardization and a consideration of the value of form, fit, and function standards to the Military.
Author (GRA)

N74-31541# Kaman Aerospace Corp., Bloomfield, Conn.
CABLE-OPERATED ZERO-IMPEDANCE DECOUPLER (COZID) Final Report
Michael A. Bowes and Ross F. Metzger Apr. 1974 147 p refs
(Contract DAAJ02-73-C-0027; DA Proj. 1F1-62202-AA-33)
(AD-780822; USAAMRDL-TR-74-4) Avail: NTIS CSCL 01/3

The ability of the helicopter to carry heavy, oversized cargo external to the airframe is a major contributor to the vehicle's operational flexibility. This capability permits the rapid transfer of an almost unlimited variety of materiel without the imposition of severe restrictions on materiel size, shape or weight distribution. One factor which imposes a potential limitation on this flexibility is the generation of high airframe/external load vibration levels caused by resonance or near resonance of the helicopter/sling/external cargo dynamic system with rotor induced forces. Alleviation of this condition, which is generally referred to as vertical bounce, is the ultimate objective of the Cable-Operated Zero-Impedance Decoupler (COZID) development effort described in the report. GRA

N74-31542# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS Annual

Progress Report, 1 May - 31 Dec. 1973
Jan. 1974 288 p refs Prepared in cooperation with Westinghouse Elec. Corp., Boulder, Colo.
(Grant NSF GI-37815)
(PB-231115/7; NSF-RA/N-74-001;
NSF/RANN/SE/GI-37815/PR/73/4) Avail: NTIS HC $6.75 CSCL 10A

The objective is to develop design parameters for solar thermal electric power systems that can provide lowest cost electric power. Parametric performance and cost models are being developed for subsystems such as the concentrator, flat plate collector, absorber heat transfer, heat transport, heat storage, heat engine, and cooling tower. Cost optimization methods are being developed, which can be used to select cost effective subsystem units, subsystem groups and to optimize the entire system. Power systems of 3 to 100 MW capacity that can be utilized in electrical networks are being considered. GRA

N74-31543# American Cyanamid Co., Stamford, Conn. Chemical Research Div.
RESEARCH ON CADMIUM STANNATE SELECTIVE OPTICAL FILMS FOR SOLAR ENERGY APPLICATIONS Annual Progress Report, 1 Jul. - 31 Dec. 1973
G. Haacke 1 Jul. 1973 27 p
(Contract NSF GI-39439)
(PB-231236/1; NSF-RA/N-74-016;
NSF/RANN/SE/GI-39539/PR/73/4) Avail: NTIS HC $3.25 CSCL 10B

The objective of the program is the development of transparent, electrically conductive cadmium stannate (Cd_2SnO_4) coatings and their incorporation into solar energy conversion devices. Technology for the preparation of crystalline Cd_2SnO_4 films will be sought during the first phase of the program. Subsequently, the electrical and optical properties of these films will be optimized by adjustment of the deposition parameters and by controlled doping. The optical properties of Cd_2SnO_4 films will be determined and the use of these films evaluated as coatings for flat plate collector covers. Heat collection efficiencies will be measured on assembled flat plate collectors. Cadmium stannate films on transparent substrates will be used as back-wall electrodes in CdS solar cells and the photovoltaic properties of these devices will be investigated. GRA

N74-31544# Mitre Corp., McLean, Va.
SOLAR ENERGY PROOF OF CONCEPT EXPERIMENTS Final Report
Dec. 1973 106 p
(Contract NSF C-831)
(PB-231143/9; MTR-6537; NSF-RA/N-73-111C) Avail: NTIS HC $4.50 CSCL 10A

Critical experiments are described which are intended to prove the technical feasibility and socio-economic desirability of specific applications or techniques for the widespread use of solar energy. These experiments fall within the following areas: heating and cooling of buildings, process heat, thermal-electric, photovoltaic, ocean thermal, wind energy, organic materials and common applications. The specific concept which the experiment is intended to prove and a rationale for the experiment are given. Each experiment is described in terms of the system to be constructed, its pacing and high-risk items, the intended users, desired interfaces with other systems and users, and estimated costs for the experiment. (Modified author abstract) GRA

N74-31482 Lockheed-Georgia Co., Marietta.
AVIONIC FLIGHT CONTROL SUBSYSTEM DESIGN AND INTEGRATION IN THE C-5 AIRPLANE
W. Elton Adams *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 12 p refs (For availability see N74-31458 21-02)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-31545*# Techtran Corp., Glen Burnie, Md.
THE RECIPROCAL EXCLUSION OF AMYLOIDOSIS-DISSEMINATED LUPUS ERYTHEMATOSUS
M. F. Kahn, J. Rousseau, C. Vitale, and M. DeSeze Washington NASA Aug. 1974 5 p refs Transl. into ENGLISH from La Nouvelle Presse Medicale (France), v. 3, no. 6, 1974 p 1033 (Contract NASw-2485)
(NASA-TT-F-15880) Avail: NTIS HC $4.00 CSCL 06E

It is observed that presence of LED mutually excludes amyloidosis and vice versa. The only known possible exceptions are cases of rheumatoid polyarthritis with amyloidosis and LE cells, but without cutaneous or visceral manifestations of LED. The consensus of opinion is that these cases belong mainly to the clinical sphere of PR (hence are susceptible to amyloidosis) and not LED. Author

N74-31546*# Pennsylvania Univ., Philadelphia. Dept. of Biology.
EFFECTS OF PROLONGED ACCELERATION WITH OR WITHOUT CLINOSTAT ROTATION ON SEEDLINGS OF ARABIDOPSIS THALIANA (L.) HEYNH
Allan H. Brown, A. O. Dahl, and Lars Loercher 31 Jul. 1974 41 p
(Grants NGR-39-030-010; NGR-39-010-149)
(NASA-CR-139584) Avail: NTIS HC $5.25 CSCL 06C

Three 21-day tests of the effects of chronic centrifugation were carried out on populations of Arabidopsis thaliana. In addition to 1 g the resultant g-forces tested were: 2,4,6,8,16, and 20 g. Observed end points included gross morphological characters such as size of plant organs and, at the other extreme, features of sub-cellular structure and ultrastructure. Plants were grown on banks of clinostats. The acceleration vector was directed either parallel with the plants' axes or transverse to the axes. Plant responses to chronic axial acceleration and to transverse acceleration with clinostated plants were determined. From the data obtained it was possible in some cases: (1) to determine the g-functions of specific plant developmental characters; (2) to extrapolate those functions to the hypothetical value at zero g in order to predict (tentatively) the morphology of a plant grown in space, (3) to describe morphological effects of clinostat rotation, (4) to determine which of those effects was influenced by the prevailing g-force, and (5) to put to direct test the assumption that clinostat rotation nullifies or compensates for the influence of gravity. Author

N74-31547*# Linguistic Systems, Inc., Cambridge, Mass.
NATURE OF THE CHANGES IN THE TENDINOUS REFLEXES IN ATHLETES
A. A. Krobova Washington NASA Aug. 1974 8 p Transl. into ENGLISH from Teor. Prakt. Fiz. Kultury (USSR), v. 22, no. 4, 1959 p 290-292
(Contract NASw-2482)
(NASA-TT-F-15735) Avail: NTIS HC $4.00 CSCL 06P

An evaluation was made of the functional status of the central nervous system, including the reception of the motor apparatus, in athletes. Studies were made of the changes in the tendinous reflexes as a function of the nature, duration, and intensity of muscular activity. Results show that: (1) tendinous reflexes actually reflect the state of excitability of the central nervous system, and (2) under the influence of muscular activity, the intensity of tendinous reflexes increases during brief muscular stress; prolonged activity, violent exercise, and working to exhaustion cause a decrease in reflex responses. Author

N74-31548*# Scientific Translation Service, Santa Barbara, Calif.
PRINCIPAL FORMS OF INTRACRANIAL HYPOTENSION, SECOND REPORT
P. Puech, P. Guilly, J. Morice, and M. Brun Washington NASA Aug. 1974 37 p Transl. into ENGLISH from Rev. Neurol. (France), v. 80, 1948 p 458-473
(Contract NASw-2483)
(NASA-TT-F-15850) Avail: NTIS HC $5.00 CSCL 16P

After a short historical survey and a discussion of some anatomical-surgical considerations, the clinical aspects of intercranial hypotension are evaluated in detail. The synthesis of physiopathological concepts now known makes it possible to carry out an interpretation test of the syndrome. Author

N74-31549*# Linguistic Systems, Inc., Cambridge, Mass.
CHANGE IN VASCULAR TONE UNDER THE INFLUENCE OF HYPODYNAMIA
V. Ye. Vasilyeva, O. N. Belina, and T. D. Vasilyeva Washington NASA Aug. 1974 5 p Transl. into ENGLISH from Probl. Kosmich. Meditsiny (Moscow), 1966 p 92-93
(Contract NASw-2482)
(NASA-TT-F-15734) Avail: NTIS HC $4.00 CSCL 06P

Before and after 10 days of hypodynamia, cardiograms from which the rate of propagation of pulse value (pwpr) was calculated were taken from test subjects, young well-trained athletes. Pwpr along elastic type vessels does not significantly change as a result of hypodynamia; pwpr along muscular type vessels drops sharply as a result of hypodynamia. A drop in the tone of muscle elements is concluded to be a logical consequence of prolonged hypodynamia. Author

N74-31550# Advisory Group for Aerospace Research and Development, Paris (France).
THE OPERATIONAL CONSEQUENCES OF SLEEP DEPRIVATION AND SLEEP DEFICIT
Averne C. Johnson (Navy Med. Neuropsychiatric Res. Unit) and Paul Naitoh (Navy Med. Neuropsychiatric Res. Unit) Jun. 1974 50 p refs
(AGARD-AG-193; AGARDograph-193) Avail: NTIS HC $5.50

The effects of total sleep loss, partial sleep loss, and sleep stage deprivation are reviewed, with particular attention to performance decrement and operational consequences. No consistent or uniform performance decrement was found in operation studies within the 36 to 48 hour range of total sleep loss most likely to be experienced by aircrew personnel, even though laboratory studies identified decrement on certain types of tasks. Physiological changes are minimal during moderate sleep loss, but mood changes are clearly noticeable. The most likely sleep problems for aircrew members are those associated with disruption of sleep-wakefulness cycles and partial sleep loss. Consistent performance decrement is difficult to find, but marked increase in fatigue is a common influence on performance, and it interacts with other stressors to enhance the stress-induced physiological responses. Deprivation of sleep stage rapid eye movement (REM) or sleep stage four produces no behavioral changes supportive of earlier beliefs that these two stages, especially stage REM, are necessary for effective waking behavior. Author

N74-31551# Scientific Translation Service, Santa Barbara, Calif.
EFFECTS OF SINGLE COMPONENTS IN AUTOMOBILE EXHAUSTS ON HUMANS AND ANIMALS
H. M. Wagner 1974 16 p Transl. into ENGLISH of the Schriftenreihedes Vereins fuer Wasser, Boden, und Lufthygiene (Berlin-Dahlem), no. 38, 1972 p 313-325 Sponsored by EPA (TR-101-74) Avail: NTIS HC $4.00

The dangers of automobile exhaust to animals and humans are investigated. Attempts were made to: (1) sample by-products of caused by exhaust reactions in the atmosphere; (2) distinguish between acute and chronic toxicity of individual exhaust components; (3) determine the combined effect of various exhaust components; and (4) develope ways to determine effects of exhaust components in low concentrations. The environmental impact of these exhausts was discussed. E.H.W.

N74-31552*# Naval Biomedical Research Lab., Oakland, Calif.
EVIDENCE FOR METABOLIC ACTIVITY OF AIRBORNE BACTERIA Quarterly Report, 1973 - 1974
R. L. Dimmick, H. Wolochow, M. A. Chatigny, P. A. Straat, J. R. Schrot, and G. V. Levin 1974 9 p refs
(NASA Order W-13450)
(NASA-CR-139620; QR-2) Avail: NTIS HC $4.00 CSCL 06M

Aerosols of the bacterium Serratia marcescens, and of uniformly labelled C-14 glucose, were created simultaneously and mixed in tubing leading to an aerosol chamber. During a subsequent period of about 5 hrs, C-14O2 was produced unequivocally within the chamber, and insoluble, labelled material within the suspended particles first increased, then decreased. Author

N74-31553*# Naval Biomedical Research Lab., Oakland, Calif.
RELEASE OF BACTERIAL SPORES FROM INNER WALLS OF A STAINLESS STEEL CUP SUBJECTED TO THERMAL STRESS Quarterly Report, 1973 - 1974
H. Wolochow, M. A. Chatigny, and J. Herbert 1974 19 p refs
(NASA Order W-13450)
(NASA-CR-139621; QR-1) Avail: NTIS HC $4.00 CSCL 06M

In an earlier report thermal stresses, simulating those expected on a Mars Lander, dislodged approximately 0.01% of an aerosol deposited surface burden, as did a landing shock of 8-10 G deceleration. This work confirms earlier results and demonstrates that release rate is not dependent on surface burden. Author

N74-31554*# Scientific Translation Service, Santa Barbara, Calif.
THE SIGNIFICANCE OF PROLONGED CLINOSTATIC HYPODYNAMIA IN THE CLINICAL PICTURE OF NERVOUS DISEASES
T. N. Krupina and A. Ya. Tizul Washington NASA Aug. 1974 12 p refs Transl. into ENGLISH from Zh. Nevropatol. Psikhiat. (USSR), no. 7, 1968 p 1008-1014
(Contract NASw-2483)
(NASA-TT-F-15895) Avail: NTIS HC $4.00 CSCL 06E

The authors studied the character of changes of the neurovegetative functions during a 62-day clinostatical hypokynesis, and their relation to motor activity. The experiments were conducted with 6 normal males in the age of 23-36. At the end of the experiment there was a definite hypotrophy of the lower extremity muscles. All these symptoms had a tendency to develop with an increase of time and were much more expressed in examinees not receiving physical exercises. Author

N74-31555*# Scientific Translation Service, Santa Barbara, Calif.
IMMUNOLOGICAL DIAGNOSTICS AND DIFFERENTIAL DIAGNOSIS OF LUPUS ERYTHEMATOSUS
Wolfgang P. Herrmann Washington NASA Aug. 1974 14 p refs Transl. into ENGLISH from Z. Dermatol., Venerol. und Verwandte Gebiete (West Germany), v. 25, no. 5, May 1974 p 209-211
(Contract NASw-2483)
(NASA-TT-F-15896) Avail: NTIS HC $4.00 CSCL 06E

Methods in current use for determination and differential diagnosis of systemic lupus erythematodes are summarized and discussed. Author

N74-31556*# Kanner (Leo) Associates, Redwood City, Calif.
ECOLOGY OF SOIL MICROORGANISMS: RELATIONSHIP BETWEEN THE NUMBER OF MICROORGANISMS IN THE SOIL AND THEIR CHEMICAL ACTIVITY
M. Nishio Washington NASA Sep. 1974 25 p refs Transl. into ENGLISH from Hakko Kyokai-shi (Japan), v. 31, no. 1, 1973 p 9-15
(Contract NASw-2481)
(NASA-TT-F-15902) Avail: NTIS HC $4.25 CSCL 06M

It is extremely difficult to determine the types and numbers of microorganisms which are actually engaged in a given metabolic activity in the soil. Currently used measuring methods, such as the dilution plate method or counting methods using microscopes, are inadequate, and more study must be devoted to other somewhat more promising methods such as staining, ATP determination, use of fluorescent antibodies, and especially autoradiography. Author

N74-31557*# Scientific Translation Service, Santa Barbara, Calif.
THERMOPHILIC AND MESOPHILIC AMINOPEPTIDASES FROM BACILLUS STEAROTHERMOPHILUS
H. Zuber and G. Roncari Washington NASA Aug. 1974 8 p refs Transl. into ENGLISH from Angew. Chem. (West Germany), v. 79, no. 20, 1967 p 906-907
(Contract NASw-2483)
(NASA-TT-F-15901) Avail: NTIS HC $4.00 CSCL 06M

Various strains of B. stearothermophilus contain different proportions of three aminopeptidases. Obligately thermophilic strains contain more of the thermophilic enzyme; obligately mesophilic strains contain very little of it, and facultative strains contain similar amounts of the three. Author

N74-31558*# Kanner (Leo) Associates, Redwood City, Calif.
IMMUNOFLUORESCENCE IN THE FIELD OF LUPUS ERYTHEMATOSUS
J. Thivolet Washington NASA Aug. 1974 11 p Transl. into ENGLISH from G. Ital. Dermatol. (Italy), v. 109, no. 3, 1974 p 187-190
(Contract NASw-2481)
(NASA-TT-F-15876) Avail: NTIS HC $4.00 CSCL 06E

The search for antinucleus antibodies by means of immunofluorescence is important in the course of acute disseminated lupus erythematosus both diagnostically, because the antinucleus antibody and other autoantibodies allow its serologic analysis, and also pathogenetically, because the multiplicity of autoantibodies shows a deep disturbance of immunoregulation. In addition, the localization of depositis of immunoglobulin in target organs (skin and kidney) seems to be related to the deposition of immune complexes containing antinucleus antibodies. These expressions of the disease have a direct pathogenic role in its determination. Acute disseminated lupus erythematosus and chronic Lupus appear thus to be not only diseases with autoimmunization, but also deriving from autoimmunization. Author

N74-31559*# Kanner (Leo) Associates, Redwood City, Calif.
GEOCHEMICAL ACTIVITY OF MICROORGANISMS IN MINERAL DEPOSITS
S. I. Kuznetsov Washington NASA Sep. 1974 26 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (USSR), v. 3, 1972 p 301-313
(Contract NASw-2481)
(NASA-TT-F-15916) Avail: NTIS HC $4.50 CSCL 06M

The activity of microorganisms was investigated in deposits of oil, ozokerite, sulfur, sulfide ores, and nonferrous metals and in lakes where deposition of lake iron-manganese ore takes place. Data are presented on distribution and activity of individual groups of microorganisms. Diagrams illustrating participation of the microorganism in formation or destruction of mineral deposits were drawn on the basis of these experiments. Author

N74-31560*# Kanner (Leo) Associates, Redwood City, Calif.
PHARMACOLOGICAL AND PHYSIOLOGICAL STUDIES ON PERSPIRATION CENTERS. 3: EFFECT OF THE MEDULA OBLONGATA ON SWEAT EXCRETION AND BODY TEMPERATURE
B. Hasama Washington NASA Sep. 1974 42 p refs Transl. into ENGLISH from Arch. Exp. Pathol. Pharm. (West Germany), v. 153, 1930 p 257-290
(Contract NASw-2481)
(NASA-TT-F-15898) Avail: NTIS HC $5.25 CSCL 06P

Injecting acidic Ringer's solution into the carotid or flushing the fourth ventricle with it causes sweat excretion and a temperature rise; alkaline solution inhibits sweat excretion and temperature rise. Elimination of the diencephalon does not change these results. Chemical and electrical stimulation are studied in order to determine the areas of the medulla oblongata which are involved, and ergotoxine and atropine are used to block the sympathetic and parasympathetic systems. The dorsal vagal nucleus is concluded to be a subordinate perspiration and thermoregulatory center made up of a sympathetic part and a parasympathetic part which react differently to chemical, thermal and electrical stimuli, independently of diencephalic centers.
Author

N74-31561*# Techtran Corp., Glen Burnie, Md.
OCCURENCE OF VIRUS-LIKE PARTICLE IN LYMPH NODES WITH LUPUS ERYTHEMATODES
U.-F. Haustein Washington NASA Sep. 1974 9 p refs Transl. into ENGLISH from Deut. Gesundheitsw. (West Germany), v. 27, no. 17, 1974 p 796-798
(Contract NASw-2485)
(NASA-TT-F-15845) Avail: NTIS HC $4.00 CSCL 06E

In lymph nodes of patients, each suffering from lupus erythematodes visceralis, lupus erythematodes chronicus disseminatus and lupus erythematodes chronicus discoides, virus-like particles (tubular-reticular structures) were detected which are localized in the endoplasmatic reticulum of the capillary endothelial cells, reticulum cells and lymphocytes. Their nature, whether they are a reaction product of the cell or nucleocapsides of (para)-myxoviruses, has not yet been determined. – Author

N74-31562*# Kanner (Leo) Associates, Redwood City, Calif.
OPHTHALMOLOGICAL PROBLEMS IN SPACE FLIGHTS
G. B. Bietti Washington NASA Aug. 1974 15 p Transl. into ENGLISH from Boll. d'Oculist. (Italy), v. 49, no. 2, 1970 p 91-101
(Contract NASw-2481)
(NASA-TT-F-15875) Avail: NTIS HC $4.00 CSCL 06P

Ophthalmological problems have a prominent place in all aspects of flight. Some of the major ophthalmological problems met in the field of aviation and space medicine, such as: hypoxia, barometric depression, the effects of acceleration and supersonic speeds, vibrations, air drafts and external temperature are reviewed. A considerable amount of space is devoted to various problems dealing with illumination (dazzling, night flights, various types of irradiations, color distinction, etc.). Author

N74-31563*# Scientific Translation Service, Santa Barbara, Calif.
PHARMACOLOGICAL AND PHYSIOLOGICAL STUDIES OF THE SWEAT CENTERS. 2: ON THE EFFECT OF DIRECT MECHANICAL, THERMAL, AND ELECTRICAL STIMULATION ON THE SWEAT AND HEAT CENTERS
Bun-ichi Hasama Washington NASA Sep. 1974 46 p refs Transl. into ENGLISH from Arch. Pharmakol. Exp. Pathol. (West Germany), v. 146, 1929 p 129-161
(Contract NASw-2483)
(NASA-TT-F-15899) Avail: NTIS HC $5.50 CSCL 06P

A thermogenetic area was found in the subthalamic region of the cat, with both mechanical and electrical stimuli. The same zones gave a temperature rise with cold stimulus and temperature lowering with heat stimulus. Other relations were shown between heat and sweat centers. The sweat-producing impulses produced by heat are apparently carried by parasympathetic nerves, and those produced by cold are carried by sympathetic nerves.
Author

N74-31564*# Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF PARAMYXOVIRUS IN AUTOIMMUNE DISEASE
R. Caputo Washington NASA Aug. 1974 6 p Transl. into ENGLISH from G. Ital. di Dermatol. (Italy), v. 109, no. 3, 1974 p 195-196
(Contract NASw-2481)
(NASA-TT-F-15878) Avail: NTIS HC $4.00 CSCL 06E

There are two different interpretations of the nature of the structures similar to paramyxovirus found in the tissues of patients suffering from autoimmune diseases: either they are aggregates of viral particles, or they are tubular formations deriving from the E. R. Although it seems to have been proven that these are not viral particles, the structures have been found very frequently in certain autoimmune diseases, thus leading some authors to believe that they reflect the presence or the ability to produce immunoglobulins. Author

N74-31565*# Kanner (Leo) Associates, Redwood City, Calif.
APPROXIMATIVE CALCULATION OF THE BUFFER BASE, THE TITRATION CURVE, AND CO2-DISSOCIATION CURVE OF BRAIN TISSUE
T. Middendorf and H. H. Loeschcke Washington NASA Aug. 1974 12 p refs Transl. into ENGLISH from Pfluegers Arch (West Ger.), v. 349, no. 1, 1974 p 1-8
(Contract NASw-2481)
(NASA-TT-F-15877) Avail: NTIS HC $4.00 CSCL 06P

An analysis of the acid-base balance and the CO2-binding capacity of the brain is presented. It is based on a linear titration curve for the cerebral proteins, the mass action laws for the first dissociation of carbonic acid and the second dissociation of phosphoric acid, the condition of electrical neutrality and finally the experimental buffer line based on the data of Kjallquist, the total phosphate ion and protein concentration of McIlwain and Bachelard. The following values for the slope of the protein titration curve, an average isoelectric point of the proteins involved and the buffer base of the whole brain were obtained: 37.18 meq/kg H20.pH; 5.718; 77 meq/kg H20. The CO2 dissociation curve derived from these data approximates the experimental data of Kjallquist. Author

N74-31566*# Linguistic Systems, Inc., Cambridge, Mass.
LUPUS INDUCED BY D-PENICILLAMINE DURING TREAT-

MENT OF RHEUMATOID-ARTHRITIS: TWO CASES AND IMMUNOLOGICAL STUDY DURING TREATMENT

J. Cruzet, J. P. Camus, A. P. Leca, P. Guillien, and J. A. Lievre Washington NASA Aug. 1974 24 p Transl. into ENGLISH from Ann. Med. Intern. (France), v. 125, no. 1, 1974 p 71-79 (Contract NASw-2482)

(NASA-TT-F-15738) Avail: NTIS HC $4.25 CSCL 06E

In investigations of Lupus induced by D-Penicillamine during treatment for rheumatoid arthritis, the course of two cases is described in detail. Then, results of a study of 25 arthritics for biological signs of Lupus during D-Penicillamine treatment of rheumatoid arthritics are examined. The cases and systematic survey confirm findings in the literature and allows definition of general clinical and biological aspects of this syndrome which appear after 10 months of treatment. Author

N74-31567*# Kanner (Leo) Associates, Redwood City, Calif.

BETA-FETOPROTEIN IN SYSTEMIC LUPUS ERYTHEMATOSUS

S. S. Vasileyskiy, V. A. Nasonova, R. V. Petrov, and O. M. Folomeyeva Washington NASA Aug. 1974 19 p refs Transl. into ENGLISH from Terapevt. Arkh. (Moscow), v. 46, no. 3, 1974 p 137-143

(Contract NASw-2481)

(NASA-TT-F-15874) Avail: NTIS HC $4.00 CSCL 06E

Data are presented on clinical-laboratory study of 14 systemic lupus erythematosus patients including descriptions of antiserum production, immunoelectrophoresis procedures and the age and length of disease distribution of the patients. Detailed case histories are presented for three patients, in whom beta 2-fetoprotein was found. It is concluded that further research is necessary for accumulation of data on the diagnostic and prognostic value of the appearance of beta2-fetoprotein and use of systemic lupus erythematosus as a model of an autoimmune disease system in solution of problems in immunogenesis. A more direct comparison of beta2-fetoprotein with the IgM(S) monomer should be made. Author

N74-31568*# Linguistic Systems, Inc., Cambridge, Mass.

INFLUENCE OF HYPOKINESIA AND A DIET COMPOSED OF HOMOGENIZED PRODUCTS ON THE FUNCTIONAL STATE OF THE HUMAN ORGANISM

P. I. Yegorov, V. S. Dupik, and N. P. Yermakova Washington NASA Aug. 1974 5 p Transl. into ENGLISH from Probl. Kosm. Medit. (Moscow), 1966 p 162-163

(Contract NASw-2482)

(NASA-TT-F-15730) Avail: NTIS HC $4.00 CSCL 06P

Four human subjects 21-29 years old were kept in horizontal position for 7 days in limited isolation. Two received a special homogenized diet. Two received a normal diet; calorie content and chemical composition were identical. Effects of isolation and diet were noted: decrease in respiration exchange in all subjects; cardiovascular changes, orthostatic instability, transitory gastrointestinal tract effects, weight loss, change in mineral volume, and auditory analyzer changes. Author

N74-31569*# California Univ., San Diego.

[RESEARCH PROGRESS IN RADIATION DETECTORS, PATTERN RECOGNITION PROGRAMS, AND RADIATION DAMAGE DETERMINATION IN DNA] Final Report, 1 Oct. 1972 - 31 Oct. 1973

Norman A. Baily 31 Oct. 1973 17 p

(Grant NGL-05-009-103)

(NASA-CR-139664) Avail: NTIS HC $4.00 CSCL 06R

The radiological implications of statistical variations in energy deposition by ionizing radiation were investigated in the conduct of the following experiments: (1) study of the production of secondary particles generated by the passage of the primary radiation through bone and muscle; (2) the study of the ratio of nonreparable to reparable damage in DNA as a function of different energy deposition patterns generated by X rays versus heavy fast charged particles; (3) the use of electronic radiography systems for direct fluoroscopic tomography and for the synthesis of multiple planes and; (4) the determination of the characteristics of systems response to split fields having different contrast levels, and of minimum detectable contrast levels between the halves under realistic clinical situations. A.A.D.

N74-31570*# University of Southern Calif., Los Angeles. Dept. of Physiology.

ROLE OF ATRIAL RECEPTORS IN THE CONTROL OF SODIUM EXCRETION Final Report

John R. Meehan and James P. Henry 10 Apr. 1973 18 p refs

(Grant NGR-05-018-122)

(NASA-CR-139677) Avail: NTIS HC $4.00 CSCL 06P

Responses of an innervated and a contralateral chronically denervated kidney to mild positive pressure breathing are compared for saline volume expansions in chloralose anesthetized dogs. It is shown that mild pressure breathing significantly reduces sodium excretion, urine flow, free water clearance, and PAH clearance. After 20 minutes of positive pressure breathing, both kidney responses are identical suggesting the release of natriuretic hormone which reduces renal function in addition to the demonstrated change in renal nerve activity. Increase of the left atrial pressure through balloon obstruction of the mitral orifice increases urine flow, sodium excretion and PAH clearance; inflation of the balloon and positive pressure breathing again depresses renal function. Preliminary evidence indicates that receptors in the right atrium are more severely affected by pressure breathing than those in the left atrium. G.G.

N74-31571*# Abilene Christian Coll., Tex.

QUANTITATIVE ECOLOGY AND DRY-HEAT RESISTANCE OF PSYCHROPHILES M.S. Thesis

Luther Winans, Jr. May 1974 116 p refs

(Grant NGR-44-095-001)

(NASA-CR-139667) Avail: NTIS HC $9.00 CSCL 06M

Microorganisms capable of growth at 7 C were enumerated and isolated from soil samples from the manufacture area (Denver, Colorado) and assembly area (Cape Kennedy, Florida) of the Viking spacecraft. Temperature requirements were determined for these isolates, and those growing at 3 C, but not at 32 C were designated as obligate psychrophiles in this investigation. These were identified to major generic groups, and the population density of obligate psychrophiles from the various groups was determined. Dry heat D-values were found for those spores that demonstrated growth or survival under a simulated Martian environment. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-31572*# Essex Corp., Alexandria, Va.

EARTH ORBITAL TELEOPERATOR SYSTEM MAN-MACHINE INTERFACE EVALUATION

Thomas B. Malone, Mark Kirkpatrick, Nicholas L. Shields, and Ronald G. Brye Jan. 1974 60 p refs Prepared in cooperation with Essex Corp., Huntsville, Ala.

(Contract NAS8-28298)

(NASA-CR-139598; H-4-1) Avail: NTIS HC $6.00 CSCL 05H

The teleoperator system man-machine interface evaluation develops and implements a program to determine human performance requirements in teleoperator systems. Author

N74-31573*# Midwest Research Inst., Kansas City, Mo.

DEVELOPMENT AND UTILIZATION OF TECHNOLOGY, CONTRIBUTIONS FROM NASA LIFE SUPPORT SYSTEMS: REFLECTIVE SUPERINSULATION MATERIALS Final Report

10 May 1974 35 p refs

(Contract NASw-2454; MRI Proj. 3720-D)

(NASA-CR-139596) Avail: NTIS HC $4.75 CSCL 06K

A case study is presented of a series of detailed investigations tracing the origins of new knowledge developed to solve specific problems of manned space exploration, and its subsequent modification and application to commercial needs. The differences that exist between the technology required for space exploration and the requirements for application to earthly problems are

discussed along with the factors which determine the time required to convert new knowledge into viable economic benefits. Various case examples disclose differing patterns of technological development. By comparing the common and contrasting findings, it may be possible to understand better how new knowledge generates real benefits. Starting from a specific knowledge contribution previously identified from an analysis of astronaut life support requirements, the origins, adaptations, and eventual significance of the new technology are presented. Author

N74-31574*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
RELATIVE DESIRABILITY OF LEISURE ACTIVITIES AND WORK PARAMETERS IN A SIMULATION OF ISOLATED WORK STATIONS Final Report, Nov. 1971 - Feb. 1974
Walter R. Sullins, Jr. and John G. Rogers Jul. 1974 59 p
(Grant NGL-01-008-001)
(NASA-CR-139651) Avail: NTIS HC $6.00 CSCL 05E

The kinds of activities that are attractive to man in long duration isolation are delineated considering meaningful work as major activity and a choice of leisure/living provisions. The dependent variables are the relative distribution between various work, leisure, and living activities where external constraints on the subject's freedom of choice are minimized. Results indicate that an average of at least five hours per day of significant meaningful work is required for satisfactory enjoyment of the situation; most other parameters of the situation have less effects on overall performance and satisfication G.G.

N74-31575*# General American Transportation Corp., Niles, Ill. Research Div.
DEVELOPMENT OF AN INTEGRATED, ZERO-G PNEUMATIC TRANSPORTER/ROTATING-PADDLE INCINERATOR/CATALYTIC AFTERBURNER SUBSYSTEM FOR PROCESSING HUMAN WASTS ON BOARD SPACECRAFT Integrated Subsystem Performance Summary Report
S. F. Fields, L. J. Labak, and R. J. Honegger Jun. 1974 76 p refs
(Contract NAS2-6386)
(NASA-CR-114764) Avail: NTIS HC $7.00 CSCL 06I

A baseline laboratory prototype of an integrated, six man, zero-g subsystem for processing human wastes onboard spacecraft was investigated, and included a development of an operational specification for the baseline subsystem, followed by design and fabrication. The program was concluded by performing a series of six tests over a period of two weeks to evaluate the performance of the subsystem. The results of the tests were satisfactory, however, several changes in the design of the subsystem are required before completely satisfactory performance can be achieved. Author

N74-31576*# North Carolina State Univ., Raleigh. Depts. of Psychology and Industrial Engineering.
EFFECTS OF NOISE UPON HUMAN INFORMATION PROCESSING
Harvey H. Cohen, Donald W. Conrad, John F. OBrien, and Richard G. Pearson Jun. 1974 67 p refs
(Grant NGL-34-002-055)
(NASA-CR-132469) Avail: NTIS HC $6.50 CSCL 05E

Studies of noise effects upon human information processing are described which investigated whether or not effects of noise upon performance are dependent upon specific characteristics of noise stimulation and their interaction with task conditions. The difficulty of predicting noise effects was emphasized. Arousal theory was considered to have explanatory value in interpreting the findings of all the studies. Performance under noise was found to involve a psychophysiological cost, measured by vasoconstriction response, with the degree of response cost being related to scores on a noise annoyance sensitivity scale. Noise sensitive subjects showed a greater autonomic response under noise stimulation. Author

N74-31577*# Techtran Corp., Glen Burnie, Md.
SPACESUIT JOINTS
M. Milkhiker Washington NASA Aug. 1974 6 p Transl. into ENGLISH from Tekh. Molodezhi (USSR), no. 6, 1974 p 27
(Contract NASw-2485)
(NASA-TT-F-15865) Avail: NTIS HC $4.00 CSCL 06K

A ball-and-socket joint to increase mobility in spacesuits was developed and successfully tested for its hermetic quality. The construction of the joint is briefly described and illustrated with photographs and a diagram. The two balls of the joint can be made of either metal or plastic with a hard molybdenum disulphide base coating for reducing friction. Adjacent connecting sections of the suit have a regular truncated cone shape and are off-center in relation to the joint; both measures are calculated to increase the angle of bending. Author

N74-31578*# Essex Corp., Alexandria, Va.
ROLE OF MAN IN FLIGHT EXPERIMENT PAYLOADS, PHASE 1
Thomas B. Malone and Mark Kirkpatrick 5 Jul. 1974 68 p refs
(Contract NAS8-29917)
(NASA-CR-120398) Avail: NTIS HC $6.50 CSCL 05E

The identification of required data for studies of Spacelab experiment functional allocation, the development of an approach to collecting these data from the payload community, and the specification of analytical methods necessary to quantitatively determine the role of man in specific Spacelab experiments are presented. A generalized Spacelab experiment operation sequence was developed, and the parameters necessary to describe each signle function in the sequence were identified. A set of functional descriptor worksheets were also drawn up. The methodological approach to defining the role of man was defined as a series of trade studies using a digial simulation technique. The tradeoff variables identified include scientific crew size, skill mix, and location. An existing digital simulation program suitable for the required analyses was identified and obtained. Author

N74-31579*# Essex Corp., Alexandria, Va.
ROLE OF MAN IN FLIGHT EXPERIMENT PAYLOADS, PHASE 1, APPENDICES 1 AND 2
Thomas B. Malone and Mark Kirkpatrick 5 Jul. 1974 212 p
(Contract NAS8-29917)
(NASA-CR-120398-APP-1-2) Avail: NTIS HC $13.75 CSCL 05E

The individual task durations are calculated in a series of time line realization problems, and a functional requirements data collection technique, designed to accommodate the data requirements for Spacelab payloads, is presented. A.A.D.

N74-31580# Meat Research Inst., Langford (England).
PERSONALITY AND SENSORY ACUITY
J. M. Harries Nov. 1973 11 p refs
(MRI-Memo-23) Avail: NTIS HC $4.00

The relationship between human extroversion scores to the assessment of meat texture in the mouth was studied by observing the difference in taste assessments completed on questionnaires and the results of food solution tests given in terms of concentration. Results indicate a relationship between extrovert personalities and less discriminating assessments of textural differences with consistently discriminating of juiciness differences in comparison with introvert personalities. G.G.

N74-31581*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE DEVELOPMENT OF A NON-CRYOGENIC NITROGEN/OXYGEN SUPPLY SYSTEM Final Report
B. M. Greenough and R. E. Mahan Feb. 1974 131 p refs
(Contract NAS9-13051)
(NASA-CR-134300; LMSC/D401948) Avail: NTIS HC $9.75 CSCL 06K

A hydrazine/water electrolysis process system module design was fabricated and tested to demonstrate component and module performance. This module is capable of providing both the metabolic oxygen for crew needs and the oxygen and nitrogen for spacecraft leak makeup. The component designs evolved through previous R and D efforts, and were fabricated and tested individually and then were assembled into a complete module which was successfully tested for 1000 hours to demonstrate integration of the individual components. A survey was made of hydrazine sensor technology and a cell math model was derived. Author

N74-31582*# Martin Marietta Aerospace, Denver, Colo.
CONFIGURATION AND DESIGN STUDY OF MANIPULATOR SYSTEMS APPLICABLE TO THE FREE FLYING TELEOPERATOR. VOLUME 1: EXECUTIVE SUMMARY Final Report
J. R. Tewell Jul. 1974 81 p refs
(Contract NAS8-30266)
(NASA-CR-120402; MCR-74-290-Vol-1) Avail: NTIS HC $7.25 CSCL 05H

A preliminary design of a manipulator system, applicable to a free flying teleoperator spacecraft operating in conjunction with the shuttle or tug, is presented. A new control technique is proposed for application to the manipulator system. This technique, a range/azimuth/elevation rate-rate mode, was selected based upon the results of man-in-the-loop simulations. Several areas are identified in which additional emphasis must be placed prior to the development of the manipulator system. The study results in a manipulator system which will provide an effective method for servicing, maintaining, and repairing satellites to increase their useful life. Author

N74-31583*# Martin Marietta Aerospace, Denver, Colo.
CONFIGURATION AND DESIGN STUDY OF MANIPULATOR SYSTEMS APPLICABLE TO THE FREEFLYING TELEOPERATOR. VOLUME 2: PRELIMINARY DESIGN Final Report
J. R. Tewell, R. A. Spencer, J. J. Lazar, C. H. Johnson, R. A. Booker, D. A. Adams, G. M. Kyrias, R. P. Meirick, R. W. Stafford, and J. D. Yatteau Sep. 1974 395 p refs
(Contract NAS8-30266)
(NASA-CR-120403; MCR-74-290-Vol-2) Avail: NTIS HC $22.75 CSCL 05H

The preliminary design of a remotely controlled teleoperator for space application is reported that depends on man for control inputs and extends operation of the space shuttle. G.G.

N74-31584*# Scientific Translation Service, Santa Barbara, Calif.
WHAT EFFECT DOES THE WARNING OF REACTIONS HAVE ON THE REACTION TIME
Manfred Amelang and Frank Lasogga Washington NASA Sep. 1974 32 p refs Transl. into ENGLISH from Arch. fuer Exp. und Angew. Psychol., v. 21, no. 1, 1974 p 1-24
(Contract NASw-2483)
(NASA-TT-F-15903) Avail: NTIS HC $4.75 CSCL 05E

Complex reaction time experiments were done with information signals indicating which reaction would be required in choice experiments. Reaction times decreased with increasing interval between information and starting signals, but were never shorter than reaction times in simple reaction time experiments. Longer exposure of the information signal gave longer reaction time. In other experiments in which interruption signals were given simultaneously with the start signals, reaction times were shorter when reactions occurred in spite of the interruption signal. Without the signal, times were longer because subjects waited for the interruption signal. Author

N74-31585*# Engineering-Science, Inc., Cincinnati, Ohio.
CORROSION CONTROL AND DISINFECTION STUDIES IN SPACECRAFT WATER SYSTEMS
T. G. Shea Mar. 1974 220 p refs
(Contract NAS9-9431)
(NASA-CR-140197) Avail: NTIS HC $14.00 CSCL 06K

Disinfection and corrosion control in the water systems of the Saturn 5 Orbital Workshop Program are considered. Within this framework, the problem areas of concern are classified into four general areas: disinfection; corrosion; membrane-associated problems of disinfectant uptake and diffusion; and taste and odor problems arising from membrane-disinfectant interaction. Author

N74-31586# Columbia Univ., New York. Psychophysics Lab.
DYNAMIC DEPTH PERCEPTION UNDER LABORATORY AND FIELD CONDITIONS Final Scientific Report
Eugene Galanter Mar. 1974 17 p refs
(Contract DADA17-68-C-8065)
(AD-779898; PLR-30) Avail: NTIS CSCL 05/10

The research was designed to assess the relations between judgments that people make and metric features of the environment (physical distance). Experiments were performed in which people made judgments of the vertical distance to an airplane that flew overhead at varying altitudes. A pilot experiment is reported of slant range judgments to aircraft at varying distances, at angles of thirty and sixty degrees above the horizon. Results of one experiment are included. These results show that judgments of time-to-touchdown of motion-picture simulations of landing approaches are unaffected by the experience of the observer or the steepness of the approach. (Modified author abstract) GRA

N74-31587# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MEDIA ADJUNCT PROGRAMMING: AN INDIVIDUALIZED MEDIA-MANAGED APPROACH TO ACADEMIC PILOT TRAINING Final Report, Feb. 1972 - Oct. 1973
Barbara Leherissey McCombs, Ruth Ann Marco, Mark W. Sprouls, A. John Eschenbrenner, and Gary B. Reid Mar. 1974 67 p refs
(Contract F41609-72-C-0015; AF Proj. 1123)
(AD-779950; AFHRL-TR-73-71(II)) Avail: NTIS CSCL 05/9

Media Adjunct Programming (MAP) techniques for presenting individualized, self-paced instruction were compared to traditional instructor-classroom (TIC) techniques in an undergraduate pilot weather course. The MAP group completed the course in significantly less time than the TIC group, representing a 29% time savings. In addition, MAP students performed equally as well on the post-test and retention test, had significantly lower state anxiety scores while learning the materials and reported significantly higher attitude scores toward the instructional method than TIC students. Predictions on the inverse relationship between state curiosity and state anxiety were partially supported, in that significant interactions were found between treatment conditions and flight groups. Possible factors contributing to flight group differences were discussed. Author (GRA)

N74-31588# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
PHYSIOLOGICAL, BIOCHEMICAL, AND PSYCHOLOGICAL RESPONSES IN AIR TRAFFIC CONTROL PERSONNEL: COMPARISON OF THE 5-DAY AND 2-2-1 SHIFT ROTATION PATTERNS
C. E. Melton, J. M. McKenzie, R. C. Smith, B. D. Polis, E. A. Higgens, S. M. Hoffmann, G. E. Funkhouser, and J. T. Saldivar Dec. 1973 19 p refs
(AD-778214/7; FAA-AM-73-22) Avail: NTIS HC $3.00 CSCL 05/10

Stress in controllers on the straight five-day shift was determined at Houston Intercontinental Tower in 1970. In 1971 controllers on the 2-2-1 rotation were studied at the same tower. Controllers generally prefer the 2-2-1 to the straight five-day schedule because of the long week end associated with the 2-2-1. Management is concerned that the quick turnaround on the 2-2-1 is a stressor that could compromise job performance. Physiological and pscyhological assessments showed no significant stress differences on the two schedules. On neither of the schedules did the controllers' stress levels differ from the general population. It was concluded that the stress differences on the two rotation patterns were too slight to be of real significance. GRA

N74-31589# Naval Postgraduate School, Monterey, Calif.
A STUDY OF DISPLAY DEVICES FOR FEEDBACK OF MEANINGFUL INFORMATION TO ELECTRO-ENCEPHALOGRAM SUBJECTS M.S. Thesis
Edward James Ohlert Mar. 1974 53 p refs
(AD-780946) Avail: NTIS CSCL 06/5

Types of tasking used in electro-encephalographic research were defined, and methods of displaying information in each tasking situation were considered. A special device for display of ASW phonograms was designed and built. Finally, a vertical display indicator group from an F-111B aircraft was obtained, and a simulated cockpit arrangement was designed incorporating this equipment. The implementation of this design will provide an advanced format for flight simulation tasking with displays particularly suited to biofeedback. (Modified author abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-31590# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
COMPOUND-TYPE SEPARATION AND CHARACTERIZATION STUDIES FOR A 370 TO 530 C DISTILLATE OF RECLUSE, WYOMING, CRUDE OIL
D. E. Hirsch, J. E. Dooley, J. W. Vogh, and C. J. Thompson 1974 29 p refs
(BM-RI-7945) Avail: NTIS HC $4.50

A systematic procedure was developed for separation, characterization, and semiquantitative analysis of high boiling (350 to 550 C) distillates of crude oils. Isothermal and molecular distillation were used to prepare the 370 to 530 C distillate of Recluse, Wyo., crude oil. The distillate was separated into fractions by chemical treatment, silica-alumina gel adsorption, and gel permeation chromatography (GPC). The fractions were analyzed by use of GPC correlations and mass and nuclear magnetic resonance (NMR) spectrometry. The increased knowledge of petroleum composition obtained from the data will contribute to improved petroleum processing and utilization and energy conservation. Author

N74-31591# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
REMOVAL OF HYDROGEN SULFIDE FROM HOT PRODUCER GAS BY SOLID ABSORBENTS
W. T. Abel, F. G. Schultz, and P. F. Langdon 1974 27 p refs
(BM-RI-7947) Avail: NTIS HC $4.50

The ability to absorb H2S from hot simulated producer gas (1,000 F to 1,5000 F) was tested for 48 materials. Sintered pellets of 75 percent fly ash and 25 percent Fe2O3 were found to be the most efficient from the standpoint of absorption capacity, durability, and amenability to regeneration. The performance of the sintered pellets under simulated and actual conditions is described, and the effects of absorbent composition, absorbent temperature, stream content of the gas, and tar vapors and dust in producer gas are discussed. Author

N74-31592# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
PRELIMINARY INVESTIGATION OF DESILICATION OF MINERALS WITH SULFUR AND CARBON
H. O. Poppleton and T. T. Campbell 1974 11 p
(BM-RI-7950) Avail: NTIS HC $4.00

A possible method for selectively removing the SiO2 component of silicate minerals and ores was investigated. Of specific interest were aluminum ores and zircon. Methods are described for removing SiO2 from these ores as volatile silicon sulfides by treating the ore with sulfur and carbon, with sulfur, carbon, and a reducing gas, or with sulfur compounds and carbon. Comparative results are also given for the desilication of some of the ores with carbon alone to form volatile silicon monoxide. The silica component can be removed partially from bauxites at temperatures above the sublimation temperature of SiS (940 C) by treatment with carbon, sulfur, and methane; however, it is more difficult to remove the silicon from kyanite, manganese silicate, red muds from aluminum processing, kaolinite, lateritic nickel ores, and zircon. Complete desilication requires temperatures ranging from 1,100 C for bauxite to 1,450 C for zircon. The high temperatures required and the undesirable metal sulfides produced eliminate practical application of this method using present tecnology. Author

N74-31593*# Virginia Univ., Charlottesville. Dept. of Chemistry.
MATRIX ISOLATION TECHNIQUE FOR THE STUDY OF SOME FACTORS AFFECTING THE PARTITIONING OF TRACE ELEMENTS
Joseph M. Grzybowski and Ralph O. Allen [1974] 26 p refs (Grant NGR-47-005-176)
(NASA-CR-139618) Avail: NTIS HC $4.50 CSCL 07D

The factors that affect the preferred positions of cations in ionic solid solutions were investigated utilizing vibrational spectroscopy. Solid solutions of the sulfate and chromate ions codoped with La(+3) and Ca(+2) in a KBr host lattice were examined as a function of the polyvalent cation concentration. The cation-anion pairing process was found to be random for Ca(+2), whereas the formation of La(+3)-SO4(-2) ion pairs with a C2 sub v bonding geometry is highly preferential to any type of La(+3)-CrO4(-2) ion pair formation. The relative populations of ion pair site configurations are discussed in terms of an energy-entropy competition model which can be applied to the partition of trace elements during magmatic processes. Author

N74-31594# Defence Research Establishment Valcartier (Quebec).
INFRARED CHEMILUMINESCENCE FROM THE REACTION OF OXYGEN ATOMS WITH CHLORETHYLENES
S. J. Arnold, G. H. Kimbell, and D. R. Snelling Mar. 1974 16 p refs
(DREV Proj. 97-01-39)
(DREV-TN-2108/74) Avail: NTIS HC $4.00

Infrared chemiluminescence from vibrationally excited CO and HCl was observed when C2H3Cl, 1,1-C2H2Cl2, cis and trans 1,2-C2 H2Cl2, or C2HCl3 was introduced into a stream of oxygen atoms. The mechanisms describing the reactions of oxygen atoms with these molecules are discussed. The initial step is postulated to involve the formation of an aldehyde and a carbene. The reaction step responsible for the formation of excited CO is postulated. Author

N74-31595*# Techtran Corp., Glen Burnie, Md.
THERMAL DECOMPOSITION OF CALCIUM SUPEROXIDE
A. B. Tsentsiper and R. P. Vasilyeva Washington NASA Aug. 1974 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Khim. (USSR), no. 6, 1968 p 1380-1382
(Contract NASw-2485)
(NASA-TT-F-15873) Avail: NTIS HC $4.00 CSCL 07D

A study has been made of the kinetics of decomposition of calcium superoxide prepared by vacuum decomposition of the compound CaO2.2H2O2. An activation energy for the process equal to 44 kcal/mole has been found. Moreover, there is initially a rise in the superoxide/peroxide ratio (samples of the superoxide are never pure, and usually contain 50% or less of the superoxide); this rise is attributed to a continuation of the same type of reaction as that involved in the initial preparation, a further oxidation of the peroxide by hydrogen peroxide still present. Later, a decomposition of the superoxide sets in; this is stated to proceed directly to the oxide. This type of reaction is explained by the supposition that the peroxide is a labile intermediate in the decomposition, and this explanation is given support by the fact that the decomposition temperature of the peroxide is not greatly above that of the superoxide. Author

N74-31596# Communications Research Centre, Ottawa (Ontario).
SPECTROSCOPIC STUDIES ON RARE-EARTH IONS IN APROTIC SOLVENT SYSTEMS Final Report
A. Watanabe, R. G. Lamont, and J. G. Chambers May 1974 18 p refs
(CRC-1248) Avail: NTIS HC $4.00

The development of materials handling equipment and spectroscopic apparatus, and detailed spectroscopic studies on Nd(3+) ions and Pr(3+) ions, are described and a survey of the spectroscopic properties of other rare earth ions is presented in relation to the spectroscopic investigations of rare earth ions dissolved in aprotic solvent systems. The investigations were carried out to demonstrate the feasibility of producing high average power liquid lasers. Author

N74-31597# Kanner (Leo) Associates, Redwood City, Calif.
DUST COLLECTION PERFORMANCE OF PAPER FILTERS
Ilnoya Koichi, Makino Kazutaka, Inoue Osamu, and Imamura Tsutomu Nov. 1973 12 p Transl. into ENGLISH from Kagaku Kogaku (Tokyo) Sponsored by EPA
(TR-166-74) Avail: NTIS HC $4.00

A description is given of experiments concerning the dust collecting performance of paper filters. Data are based on the single fiber collecting efficiency theory in the diffusion interception

dominant area of fiber layer filters. Volume fraction, logarithmic penetration properties, and filter thickness were used as parameters of collection efficiency. Author

N74-31598# Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF SULFURIC ACID MIST
Nov. 1973 36 p refs Transl. into ENGLISH of the report of the Fukuoka Prefectural Health Inst., Miyagi Prefectural Health Inst., Sato Shinsaku, Kikuchi Kaku, Osaka Municipal Health Inst. Sponsored by EPA
(TR-167-74) Avail: NTIS HC $.500

A study was made of methods of measuring H2SO4 mist generated by various methods and present together with SO2. Data cover: (1) high sensitivity methods of quantitative analysis of H2SO4 mist; (2) methods of sampling H2SO4 mist in the atmosphere; and (3) actual measurements in polluted areas and disturbing substances. Author

N74-31599*# Kanner (Leo) Associates, Redwood City, Calif.
VARIOUS METHODS FOR EVALUATING SPECTRA IN QUANTITATIVE SPECTROCHEMICAL ANALYSES
H. Kaiser Washington NASA Sep. 1974 27 p refs Transl. into ENGLISH from Spectrochim. Acta (England), v. 2, 1941 p 1-17 (German language document)
(Contract NASw-2481)
(NASA-TT-F-15919) Avail: NTIS HC $4.50 CSCL 07D

A review is given of the various procedures which can be used in exact spectrochemical analyses to evaluate photographed spectra. First discussed is the method of evaluation which depends on the use of internal standards using density differences, and whose range of applicability can be extended considerably using Seidel's extension of the blackening curve. Then the principles of procedures without the use of internal standards are discussed, which are based on the measurement of the true intensity relations between analysis lines. Both for the complete, as well as for the simplified methods, protocols are given that can be used in routine analyses. The bridging of large differences in wavelengths using a bridge spectrum is extensively explained; finally, it is shown that the free procedures are superior in accuracy to the dependent ones. Author

N74-31600*# Kanner (Leo) Associates, Redwood City, Calif.
INFLUENCE OF BACKGROUND ON THE FORM OF SPECTROCHEMICAL CALIBRATION CURVES
H. Kaiser Washington NASA Sep. 1974 31 p refs Transl. into ENGLISH from Spectrochim. Acta (England), v. 3, 1948 p 297-314 (German language document)
(Contract NASw-2481)
(NASA-TT-F-15905) Avail: NTIS HC $4.75 CSCL 07D

Spectrochemical calibration curves are generally curved if the intensity of the spectrum background is not taken into account. If the background intensity is subtracted, a straight line is usually obtained. The equations for the (true) straight line and for the uncorrected calibration curve are set up. Each may be calculated from the other. In limited concentration ranges, the calibration curve may be approximated by a straight line. The equations for these substitute straight lines are derived. A simple formula is developed for the systematic errors of analysis generated by the use of a substitute straight line. A criterion for the necessity of a background correction is derived and depicted in the form of a graph. The theory is illustrated by an example. In the appendix, the effect on the background correction due to an incorrect filter value is described. Author

N74-31601*# Linguistic Systems, Inc., Cambridge, Mass.
INVESTIGATION OF SYNTHETIC FLUIDS BASED ON N-SUBSTITUTED MELAMINES
G. Spengler, H. Lindinger, and R. Worle Washington NASA Aug. 1974 20 p refs Transl. into ENGLISH from Ardoel und Kohle, v. 25, no. 6, Jun. 1972 p 317-322
(Contract NASw-2482)
(NASA-TT-F-15831) Avail: NTIS HC $4.00 CSCL 07D

Derivatives of resonance stabilized heterocyclic compounds, such as s-triazines, seem to be suitable lubricant bases, due to their structure, showing high thermal and oxidation stability. Starting from 2,4,6-trichloro-s-triazine and secondary amines, symmetric and asymmetric substituted 2,4,6-(di-alkylamino)-s-triazine derivatives were synthesized and their thermal stability and thermal oxidation stability was investigated. Furthermore, their viscosity, viscosity-temperature dependence, and low temperature properties were determined. The obtained results were compared with those of known esters and polyphenyl ether based synthetic oils. Author

N74-31602*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
VIBRATIONAL INTENSITY DISTRIBUTIONS FOR CONTINUUM PHOTOIONIZATION OF OXYGEN
J. L. Gardner and James A. R. Samson 1974 5 p refs Sponsored in part by NSF
(Grant NGR-28-004-021)
(NASA-CR-139676) Avail: NTIS HC $4.00 CSCL 07D

Results from measurements of vibrational intensity distributions for continuum photoionization of O2 are reported. Measurements were made using the 584 and 304 A He lines. The photoionization cross section of O2 shows a substantial dip in magnitude over a 20 A band centered about 590 A; thus the possibility exists that a 584 A photoelectron spectrum of O2 includes an autoionized contribution and the vibrational intensity distributions may not correspond to those of continuum ionization. Oxygen photoionization cross section shows no structure around 304 A and purley continuum ionization is expected. Author

N74-31603# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
HIGH TEMPERATURE OXIDATION OF GRAPHITE BY A DISSOCIATED OXYGEN BEAM
George Nung-Keung Liu Aug. 1973 218 p refs
(Contract F44620-71-C-0009; AF Proj. 9781; MIT Proj. DSR-72803)
(AD-779949; TR-186; AFOSR-74-0872TR) Avail: NTIS CSCL 07/4

Graphite oxidation by dissociated oxygen has been studied by molecular beam-mass spectrometry techniques. A high temperature atomic oxygen beam source (capable of generating an atom-to-molecule flux ratio of 0.5) and a modulated, pulse-counting detection scheme have been developed for the study. The target (isotropic graphite) temperature was varied from 1000 to 1700K with a beam temperature range of 300 to 2200K and an equivalent beam pressure of about 10 to the minus eighth 10 to minus ninth power atm. Measurements were carried out in the principal plane, and both beam incident and detector angles, measured from the target normal, were varied independently. (Modified author abstract) GRA

N74-31604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL ACTION OF LASER RADIATION
V. L. Talroze and P. O. Barashev 19 Apr. 1974 59 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchest. (USSR), v. 18, 1973 p 15-33
(AD-779811; FTD-MT-24-500-74) Avail: NTIS CSCL 07/5

Chemical transformations in various substances and materials exposed to laser rays are discussed. Data are also given on the use of lasers to study chemical reactions and processes. Radiation field characteristics and laser design are included. Author (GRA)

N74-31605# Space Sciences, Inc., Monrovia, Calif.
A MASS SPECTROMETRIC INVESTIGATION OF ADDITIVES IN ALKALI-SEEDED H2/O2 FLAMES Final Technical Report, 1 Nov. 1968 - 30 Apr. 1974
Milton Farber, S. P. Harris, R. D. Srivastava, O. M. Uy, and G. W. Wheeler 31 May 1974 23 p refs
(Contract N00014-69-C-0014)
(AD-780969) Avail: NTIS CSCL 07/4

The report concerns investigation of the chemical and thermodynamic reactions of various metal additives to unseeded and potassium seed atmospheric H2/O2 flames. A study of Al, F, H2/O2 reactions is included. Abstracts of other papers and reports which involved B, Mo, W, Cr, V, Fe, Re, As, and Sb as additives are presented. Experimental equipment and design are discussed. GRA

N74-31606# Bureau of Mines, Laramie, Wyo. Energy Research Center.
SECOND-ORDER EFFECTS IN THE KINETICS OF OIL SHALE

PYROLYSIS
Donald W. Fausett, John H. George (Wyo. Univ., Laramie), and Harry C. Carpenter Mar. 1974 26 p refs
(PB-231279/1; BM-RI-7889) Avail: NTIS HC $3.25 CSCL 07D

The report presents a system of thermal decompositions providing an adequate description of the mechanism of oil shale pyrolysis. Specific rate constants for systems of thermal decompositions studied are estimated via a least squares procedure. The estimates thus obtained provide a mathematical method of the corresponding thermal decomposition system. A model which generates a good fit to published Bureau of Mines experimental data, in comparison with other models studied, is based on a thermal decomposition system consisting of two first order reactions and three second order reactions. Values computed for the specific rate constants corresponding to this system are shown to exhibit a temperature dependence which is in good agreement with the Arrhenius equation. GRA

N74-31607# Systems Science and Software, La Jolla, Calif.
A STUDY OF EQUATIONS OF STATE/OPACITY OF IONIZED GASES Final Report, 31 Oct. 1972 - 31 Oct. 1973
James M. Harvey, Ira Katz, and Robert C. Vik Oct. 1973 87 p refs
(Contract DNA001-73-C-0061)
(AD-779890; SSS-R-73-1946; DNA-3278F) Avail: NTIS CSCL 07/4

The report describes additions and modifications to the CAPO system of opacity codes and presents the results of other research tasks on emission, absorption and transport of radiation in high temperature materials. The accuracy of several approximate methods of opacity treatment is assessed. The radiative properties of thin plasmas, not in local thermodynamic equilibrium (non-LTE) are considered. Several codes written to provide ionic charge distributions, excited state populations, and emission rates in non-LTE plasmas are described. Electron positron pair production rates are studied and estimates made of the times required to establish significant pair populations under various conditions.
Author (GRA)

N74-31608# Naval Ammunition Depot, Crane, Ind.
SPECTROSCOPIC ANALYSIS OF AZIDE DECOMPOSITION PRODUCTS FOR USE IN A PYROTECHNICALLY INITIATED CARBON DIOXIDE CHEMICAL LASER
Carl E. Dinerman 10 May 1974 23 p refs
(AD-780788; NAD-CR-RDTR-269) Avail: NTIS CSCL 07/4

In the consideration of Sodium azide as a potential nitrogen source for a nitrogen-carbon dioxide chemical laser, it is important to know the fraction of the heat of decomposition of the azide that will appear as vibrational excitation in the nitrogen. To this end, the progressions of the Lyman-Birge-Hopfield bands of nitrogen were monitored by means of absorption spectroscopy in the vacuum ultraviolet, upon thermal decomposition of sodium azide. The experimental system is described and results to date are discussed. (Modified author abstract) GRA

N74-31609# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROSCOPY OF THE VAPORS OF COMPOUNDS WITH LOW VOLATILITY SUPERCOOLED IN A SUPERSONIC FLOW
D. I. Kataev and A. A. Maltsev 30 Apr. 1974 21 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (USSR), v. 64, no. 5, May 1973 p 1527-1537
(AD-780832; FTD-HT-23-783-74) Avail: NTIS CSCL 07/4

For molecular spectroscopy and related methods of studying molecule structure, including the development of gasdynamic lasers, a problem of immediate importance is that of obtaining the vapors of compounds with low volatility in the gas phase at translational and rotational temperatures close to absolute zero and at densities sufficient for spectrum registration. It has been shown that conditions for such great supercooling can be created in a supersonic flow. Three systems are examined. In the first of these supercooling is produced in a supersonic flow of pure vapors from a furnace or a shock tube. The second system differs from the first in that the vapors are mixed with an inert gas. In the third system the vapors are diffused into the boundary layer of a supersonic flow of cold inert gas through the porous furnace wall which is parallel to the flow. GRA

N74-31610# Tennessee Valley Authority, Chattanooga. Div. of Environmental Planning.
FULL-SCALE DESULFURIZATION OF STACK GAS BY DRY LIMESTONE INJECTION. VOLUME 3: APPENDICES I THROUGH L Final Report
F. E. Gartrell Aug. 1973 343 p refs Sponsored by EPA
(PB-230385/7; EPA-650/2-73-019C) Avail: NTIS HC $20.75 CSCL 13B

The report gives results of a test program of dry limestone injection, demonstrated on a 150-Mw pulverized-coal-fired boiler at TVA's Shawnee Plant. The program included: equipment shakedown, dust distribution studies, process optimization, and long-term injection trials. The program is discussed in context with previous investigations and EPA-sponsored support activities. Appendices contain test program detail results and results of EPA support projects. Because of low SO2 removal efficiencies and the potential for major reliability problems, it does not appear that dry limestone injection will play an important role in controlling SO2 emissions from power plants. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-31611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE BEAMWIDTH MONOPULSE FEED FOR TRACKING AND DATA RELAY SATELLITE (TDRS)
Richard F. Schmidt Jun. 1974 30 p refs
(NASA-TM-X-70737; X-811-74-170) Avail: NTIS HC $4.50 CSCL 17B

The Tracking and Data Relay Satellite with a set of circularly-polarized, amplitude-sensing monopulse patterns suitable for acquiring and tracking user spacecraft at Ku-band (15.0 GHz) is discussed. The possibility of increasing the less than 0.4-degree half-power beamwidth of the data beam to almost 1.0 degree during the acquisition phase is predicated on the use of feeds situated in the first bright-ring of the Airy diffraction structure. A complex-vector simulation equivalent to the Kirchhoff-Kottler or Franz formulations is used to compute transmitted and received field information for a dual-reflector (Cassegrain) antenna configuration in a three-dimensional space.
Author

N74-31612*# George Washington Univ., Washington, D.C.
THE POTENTIAL FOR CONGRESSIONAL USE OF EMERGENT TELECOMMUNICATIONS: AN EXPLORATORY ASSESSMENT
Fred B. Wood May 1974 68 p refs
(Grant NGL-09-010-030)
(NASA-CR-139669; GWPS-MON-20) Avail: NTIS HC $3.75 CSCL 17B

A study of the use of newly emerging communications technology for improving the understanding between members of Congress and their constituents was conducted. The study employed a number of specific methodologies such as interdisciplinary systems model building, technology analysis, a sample survey, and semi-structured interviews using sketches of the emergent channels. The following configurations were identified as representative of emergent channel characteristics: (1) the teleconference, (2) the videoconference, (3) the videophone, (4) cable television, (5) cable television polling, and (6) information retrieval. Analysis of the interview data resulted in an overview of the current congressional-constituent communication system and an assessment of the potential for emergent telecommunications, as perceived by congressmen and senior staff from 40 offices in the stratified judgement sample. Author

N74-31613*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, May - Jun. 1974
15 Aug. 1974 232 p refs
(Contract NAS7-100)
(NASA-CR-139582; JPL-PR-42-22) Avail: NTIS HC $6.00 CSCL 22D

The objectives, functions, and organization, of the Deep Space Network are summarized. Deep Space stations, ground communications, and network operations control capabilities are described. The network is designed for two-way communications with unmanned spacecraft traveling approximately 1600 km from earth to the farthest planets in the solar system. It has provided tracking and data acquisition support for the following projects: Ranger, Surveyor, Mariner, Pioneer, Apollo, Helios, Viking, and the Lunar Orbiter. M.C.F.

N74-31614*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS) FREQUENCY PLAN
Aug. 1974 47 p
(NASA-TM-X-70730; X-805-74-230) Avail: NTIS HC $5.50 CSCL 17B

The functions of the Tracking and Data Relay Satellite System (TDRSS) are discussed. The primary purpose of the system is to transmit signals to and receive signals from earth orbiting user spacecraft, and provide data from which user spacecraft ephemerides can be calculated. The system configuration is described and illustrated. The frequency plan is analyzed to show the frequency coverage and the signal handling capability of the system. The characteristics of the components of the system are tabulated. Author

N74-31615*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF TURBULENCE IN THE ATMOSPHERE OF VENUS ON PIONEER VENUS RADIO, PHASE 2
R. T. Woo and W. Kendall 15 Aug. 1974 30 p refs
(Contract NAS7-100)
(NASA-CR-139657; JPL-TM-33-702) Avail: NTIS HC $4.50 CSCL 17B

Two problems related to the effects of turbulence in the atmosphere of Venus on the Pioneer entry probe radio link were studied. In the first problem, the cross correlation between the log amplitude and phase fluctuations of the Pioneer Venus communications link is examined. Data show that for fluctuation frequencies above approximately 1 Hz there is little or no correlation. For frequencies below this region the correlation is weak and the square root of the coherence has a peak value close to 0.65. The second problem consists of interferring turbulence characteristics of the Venus atmosphere from the Mariner 5 phase fluctuations. Data show that with the data processing techniques developed and currently available, the phase error due to oscillator drift, assumed trajectory delay, and spline curve fit exceed the turbulence induced fluctuations. Results show that it is not possible to interfere with the turbulence characteristics from Mariner 5 phase fluctuations. Author

N74-31616*# Illinois Univ., Urbana. Aeronomy Lab.
COLLECTION AND PROCESSING OF DATA FROM A PHASE-COHERENT METEOR RADAR
C. A. Backof, Jr. and S. A. Bowhill 1 Apr. 1974 126 p refs
(Contract NGR-14-005-181)
(NASA-CR-139650; UILU-Eng-74-2502; Aeronomy-59) Avail: NTIS HC $9.50 CSCL 17I

An analysis of the measurement accuracy requirement of a high resolution meteor radar for observing short period, atmospheric waves is presented, and a system which satisfies the requirements is described. A medium scale, real time computer is programmed to perform all echo recognition and coordinate measurement functions. The measurement algorithms are exercised on noisy data generated by a program which simulates the hardware system, in order to find the effects of noise on the measurement accuracies. Author

N74-31617*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROPELLER MODULATION EFFECTS ON A SCANNING BEAM MICROWAVE LANDING SYSTEM
Jack M. Pope and William H. Staehle Jul. 1974 42 p refs Prepared in cooperation with Raytheon Co., Wayland, Mass.
(NASA-TM-X-62368) Avail: NTIS HC $3.25 CSCL 20N

An investigation to assess the modulation effects on microwave signals transmitted through rotating propeller blades. Interruption of the antenna line-of-sight signal by the rotating propeller causes a variation of path loss, which produces essentially an amplitude modulation of the received signal. This interruption or blockage effect is generally only partial because of edge diffraction around the particular interfering propeller blade. Signals reflected from the rotating propeller will also cause Doppler frequency shifts to be present in the received signals. A scanning beam microwave landing system (MLS) known as MODILS (modular instrument landing system) was used to process the received signals for display. The effects of propeller modulation were studied by varying the following parameters: (1) spacing between propeller and receiving antenna, (2) propeller dimensions, (3) propeller speed (rpm), (4) number of propeller blades, (5) system data rate, (6) receiver response time, and (7) receiver antenna aperture. Author

N74-31618*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM USER IMPACT AND NETWORK COMPATIBILITY STUDY Final Report, 19 Jun. 1972 - 19 Jun. 1973
19 Jun. 1973 121 p refs
(Contract NAS5-20357)
(NASA-CR-139045; HS-337-0102-12; HAC-Ref-C6966) Avail: NTIS HC $9.25 CSCL 17B

The report contains data on antenna configurations for the low data rate users of the Tracking and Data Relay Satellite System (TDRSS). It treats the coverage and mutual visibility considerations between the user satellites and the relay satellites and relates these considerations to requirements of antenna beamwidth and fractional user orbital coverage. A final section includes user/TDRS telecommunication link budgets and forward and return link data rate tradeoffs. Author

N74-31619*# Scientific Translation Service, Santa Barbara, Calif.
TRANSMISSIONS OF BLACK AND WHITE TV PICTURES OVER COMMUNICATION CHANNELS WITH 1 MHz BANDWIDTH
M. Lange Washington NASA Aug. 1974 62 p refs Transl. into ENGLISH of "Die Uebertragung von Schwarzweiss-Fernsehbildern ueber Nachrichtenwege mit 1 MHz Bandbreite," Darmstadt, report no. FTZ-A-44-TBr-30, Aug. 1971 58 p
(Contract NASw-2483)
(NASA-TT-F-15870; FTZ-A-44-TBr-30) Avail: NTIS HC $6.25 CSCL 17B

The possibility of television transmission using a significantly reduced bandwidth which may be of advantage for certain CCTV (closed circuit TV) applications is discussed. Problems such as the effective bandwidth requirement of a given TV standard, pulse transmission over a signal channel of limited bandwidth, picture quality, and its determination have been studied. Experiments involving restricted bandwidth transmission of signals using the TV broadcasting standard and using a videophone standard are described. It is concluded that the 1 MHz bandwidth is sufficient for useful Tv transmissions. Author

N74-31620# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
COMPUTER-AIDED DESIGN IN TELEVISION CIRCUITS
Kotaro Wakui, Tadashi Kawashima, Akinobu Wakabayashi, and Tooru Mochizuki Nov. 1973 32 p refs
(NHK-Tech-Mono-22) Avail: NTIS HC $4.75 CSCL 17B

The research and development activities on computer aided design of television circuits are discussed. In the area of program application, the design review of a compact standard color television camera was carried out by use of computer programs, resulting in improved performance, stability, and reliability. Details of the computer programs are described and examples of the circuits are diagrammed. Author

N74-31621# Japan Broadcasting Corp., Tokyo. Technical Research Labs.

VIDEO DISPLAY TECHNIQUE FOR X-RAY DIFFRACTION TOPOGRAPHY
Jun-ichi Chikawa and Isao Fujimoto Mar. 1974 22 p refs
(NHK-Tech-Mono-23) Avail: NTIS HC $4.25 CSCL 14B

A direct viewing technique of topographic images (diffraction micrographs) was developed by a TV system with the aid of a high power X-ray generator. The diffracted intensity necessary for the direct viewing was estimated by considering photon noise. To obtain the intensity, the continuous and stable operation of the X-ray generator at 60kV and 0.5A with a focus size of 0.5x10mm was achieved with Cu-Cr (1%) alloy- and Mo-rotating targets. An X-ray sensing vidicon camera tube was used which had a PbO target layer with an optimum thickness of 15 microns, and a resolution of better than 25 microns was obtained. For transmission topography, two regions each with a width of 1mm on a specimen crystal are seen on a picture monitor with K alpha 1 and K alpha 2 radiations. By moving both the crystal and TV camera and storing the K alpha 1 images consecutively in an image storage tube, a Lang topograph with an area of 13x9mm is synthesized in 3 to 10 sec. This storage improves the image quality and results in a signal-to-noise ratio of about 10 for individual dislocation images in Si crystals. The characteristics of the system are shown by some examples using the Lang, Berg-Barrett, and double crystal methods. The capability of the system is demonstrated by some in situ observations of dislocation motion and melt-growth process of Si crystals. Author

N74-31622# Defence Research Establishment Valcartier (Quebec).
APPLICATION OF THE BOUNDARY-DIFFRACTION-WAVE THEORY TO GAUSSIAN BEAMS
G. Otis Mar. 1974 21 p refs
(DREV Proj. 97-01-20)
(DREV-TN-2114/74) Avail: NTIS HC $4.25

When applied to a plane or spherical incident wave, the boundary-diffraction-wave (BDW) theory expresses the total field diffracted by an aperture as the interference of two component waves, a boundary-diffraction-wave and, if allowed by geometrical considerations, an unperturbed wave originating from the source. Using properly defined complex amplitude and complex phase functions, it is shown here that, under conditions usually satisfied in practical situations, the diffraction problem involving a Gaussian incident beam can be interpreted in terms of the BDW theory. Examples of calculations are given for Gaussian beams with cylindrical symmetry. The general equation for the ray paths associated with the Gaussian beams is also derived, and it is used to show that the shadow boundary behind the diffracting screen follows a hyperbola. Author

N74-31623* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 8 THROUGH 17 TECHNICAL AIR-TO-GROUND VOICE TRANSCRIPTIONS
Dec. 1968 5642 p
(NASA-TM-X-70144) Avail: NTIS in sets of 6 16mm microfilm reels or cartridges (specify type): reel, $26.00; 3M cartridge, $38.00; recordak cartridge, $38.00; or thread easy magazine, $38.00 CSCL 17B

Magnetic tape recordings of air to ground voice communications which were conducted during Apollo flights are presented. Conversations were recorded on Apollo flights 8 through 17. The tapes are identified as prime goss air-to-ground voice transcriptions for each of the flights. P.N.F.

N74-31624# University of South Florida, Tampa. Dept. of Physics.
NONLINEAR ELECTROSTATIC ION WAVES Annual Progress Report
W. D. Jones and N. L. Oleson 1 Feb. 1974 50 p refs
(Contract AT(40-1)-4338)
(ORO-4338-3) Avail: NTIS HC $4.50

These experiments fall in the categories of both linear and nonlinear ion acoustic waves, pseudowaves, and plasma diagnostics. In addition, two new plasma facilities are being planned, with the construction of one being well underway. Although the experiments fall predominantly in the linear regime, the results obtained have strong implications for understanding the low-frequency behavior of hot, dense, turbulent, Vlasov plasmas in which strong density gradients, large-amplitude ac electric fields, and coherent particle motion predominate. NSA

N74-31625# Calspan Corp., Buffalo, N.Y.
ABSORPTION OF ELECTROMAGNETIC RAYS NEAR THE CRITICAL DENSITY Quarterly Progress Report, 1 Jun. - 1 Sep. 1973
J. W. Daiber, R. G. Rehm, and H. M. Thompson 1973 7 p
(Contract AT(11-1)-2288)
(COO-2288-3) Avail: NTIS HC $4.00

An experimental study of the interaction of high intensity ruby laser radiation with hydrogen gas in a free jet is described. In these experiments, both laser intensity and the plasma frequency can be varied. By monitoring several parameters, including incident and reflected power, X-ray emission and the kinematics of plasma growth, the existence of an anomalous threshold for coupling radiation into plasma energy should be determinable. A discussion of the experiment, including a design drawing of the experimental arrangement and the diagnostic instrumentation, is included. Author (NSA)

N74-31626# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF VERTICAL DIRECTION FINDING UNAFFECTED BY THE PRESENCE OF THE GROUND
P. W. James Dec. 1973 36 p
(RAE-TR-73131; BR38497) Avail: NTIS HC $5.00

Reflections from the ground cause a serious difficulty with systems intended to measure the elevation angle of a source of radio waves. A method is proposed, using a vertical array, which is in principle unaffected by these reflections. It is shown that the method is insensitive to measurement errors.
Author (ESRO)

N74-31627# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL DETERMINATION OF SMALL AND MEDIUM SIZE PROJECTILE RADAR CROSS SECTION [EXPERIMENTELLE BESTIMMUNG DES RADAR-QUERSCHNITTES VON GESCHOSSEN KLEINEN BIS MITTLEREN KALIBERS]
M. Koenig and B. Koch 15 Jun. 1973 53 p refs In GERMAN
(ISL-17/73) Avail: NTIS HC $5.75

The results of radar cross section measurements of projectiles between 5.6 mm and 55 mm using a free space standing wave method in the X band (wavelength = 3.2 cm), are reported. The computable cross sections of spheres and circular disks with several diameters were used as reference bodies. The measurements cover the total azimuth angle range between 0 deg (projectile ground) and 180 deg (projectile peak). They are especially intended to be used for a more exact numerical estimation of the performance of Doppler radar equipment for the trajectory measurement of small and medium size projectiles. ESRO

N74-31628# Technische Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
ABERRATION AND OPTICAL DOPPLER EFFECT BASED ON RELATIVITY THEORY [ABERRATION UND OPTISCHER DOPPLEREFFEKT - RELATIVISTISCH BEGRUENDET]
Manfred Schneider 1974 60 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(Tum-Mitt-106) Avail: NTIS HC $6.00

A systematic treatment of the aberration and Doppler shift of electromagnetic waves is presented, based on special relativity theory. The starting point is the phase invariance of an electromagnetic wave under the Lorentz transformation. Several formulas are derived for various applications in astronomy, geodesy and satellite tracking. ESRO

N74-31629# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
LONG-PERIOD FADING OF SHORT WAVE SIGNALS [LANGPERIODISCHES FADING VON KURZWELLENSIGNALEN]
W. Dieminger and J. Roettger Bonn Bundeswehramt 1974 24 p refs In GERMAN; ENGLISH summary Sponsored by

Bundesmin. fuer Verteidigung
(BMVg-FBWT-74-2) Avail: NTIS HC $4.25; Bundeswehramt 20 DM

An explanation is given for long term fading of short wave signals found on the radio path between Lindau and Tsumbe for continuous wave transmission. The field strength variations were found to occur often in a period from 10 to 80 minutes. These near-periodic variations can be explained from focusing effects resulting from periodic variations of the electron density distribution along the propagation path. It is assumed that these latter variations are originated by atmospheric gravity waves. Quadratic power spectra of long term fading calculated from field strength measurements were compared with results obtained from ray tracing calculations. Author (ESRO)

N74-31630# European Space Research Organization, Paris (France).
CONVERSION SYSTEMS FOR PICTURE SIGNALS
Christian Johansen Jun. 1974 72 p refs Transl. into ENGLISH of Umwandlungsanlagen fuer Bildsignale, DLR-MITT-73-32, DFVLR, 2 Oct. 1973
(ESRO-TT-65; DLR-MITT-73-32) Avail: NTIS HC $5.75; DFVLR, Porz, West Ger. 16,50 DM

Data compression methods for picture signals are discussed. Analog signals from a picture scanner are converted into digital form, processed and reconverted into analog form for the purpose of reproducing the picture. The associated conversion systems, the data processing system and the picture scanning and recording units are described and their characteristic data listed in tables. Particular attention was given to the clock and control signals, band-width limiting and amplitude quantization of the picture signals, and to the interference produced by the signal sources. Gradation correction by means of a subprogram and operational experience with the system are described. Author (ESRO)

N74-31631# AEG-Telefunken, Backnang (West Germany). Microwave Tube Dept.
TWTA EFFICIENCY IMPROVEMENT STUDY Final Report
N. Pranter 30 Aug. 1973 109 p refs
(Contract ESTEC-1568/72-JS)
(ESRO-CR(P)-427) Avail: NTIS HC $8.50

Efficiency improvement of traveling wave tube amplifiers for use in communication satellites was studied. Concepts of multistage collectors are discussed and collector selection criterions are dealt with. Characteristics of single and double stage collectors were compared. Integration of TL12022 and EPC is discussed. ESRO

N74-31632# European Space Research Organization, Paris (France).
PHASE CHARACTERISTICS OF A PLATINOTRON
Helmut Kietzmann May 1974 43 p refs Transl. into ENGLISH of Phasenschwankungen eines Platinotrons, DLR-MITT-73-03, DFVLR, 21 Nov. 1972
(ESRO-TT-54; DLR-MITT-73-03) Avail: NTIS HC $5.25; DFVLR, Porz, West Ger. 14,50 DM

The statistical pulse-to-pulse phase variations of a platinotron, which have not been determined previously, are measured using a test arrangement based on the counter wave measuring principle. An analysis of the results obtained provides a quantitative statement on the frequency distributions of the statistical phase variations, leading to an assessment of the possible applications of this valve. Author (ESRO)

N74-31633# Marconi Co., Ltd., Chelmsford (England).
A SURVEY OF FREQUENCY BANDS SUITABLE FOR SATELLITE COMMUNICATIONS SYSTEMS INVOLVING SMALL FIXED EARTH TERMINALS
Apr. 1974 216 p refs
(Contract ESRO-SC/16/73-HQ)
(ESRO-CR(P)-457) Avail: NTIS HC $14.00

The suitability of using frequency bands above 14.5 GHz for a fixed satellite system comprising small earth terminals has been investigated. The antennas are not larger than 3.5 m. The modulation is digital, either single carrier/transponder or TDMA. The satellite transponder is of the hard limiting variety, output power independent of input power, and the option of digital regeneration in the satellite is considered. Allocations are proposed between 10 and 30 GHz. The prediction of attenuation due to precipitation is discussed, as well as space diversity. The parametric link budgets are produced, and several critical hardware components are examined for both earth terminals and satellites. Three transmission models are described, and the interference situations are examined. ESRO

N74-31634# Naval Electronics Lab. Center, San Diego, Calif.
A PROGRAM FOR COMPUTING EARTH IONOSPHERE ELF/VLF EXCITATION FACTORS FOR SATELLITE-BORNE ANTENNAS Interim Report
Richard A. Pappert and Linda R. Shockey 1 Apr. 1974 79 p refs
(AD-779867; NELC-IR-741) Avail: NTIS CSCL 17/2

The report presents a variation of an earlier fields program. This variation is designed specifically for the purpose of calculating excitation factors of the earth-ionosphere wave guide by point dipoles at satellite heights. In particular, allowance is made for the following: (1) provision for calculating excitation factors for all electric field components, E sub x, E sub y and E sub z; (2) provision for calculating excitation by both electric and magnetic point dipoles; (3) provision for calculating excitation by vertical, horizontal end on and horizontal broadside configurations. Author (GRA)

N74-31635# Naval Research Lab., Washington, D.C.
AN EVALUATION OF MODULATION SYSTEMS Final Report
Don J. Torrieri and James N. OConner 11 Aug. 1973 30 p refs
(NRL Proj. R06-55)
(AD-779842; NRL-7609) Avail: NTIS CSCL 17/2

The report summarizes the results of a theoretical and experimental study of the relative strengths and weaknesses of amplitude shift keying, phase shift keying and quadriphase shift keying systems. The report is a combination review report and research monograph. Ideal theoretical results are discussed, and methods of practical realization are described. New research results include the determination of the standard deviation of the arrival time as a function of modulation, simple formulas for the degradation in both digital and analog systems due to adjacent-channel interference, and simple upper bounds for intersymbol interferences. The use of the formulas are all examined experimentally. Author (GRA)

N74-31636# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
ELECTROMAGNETIC RADIATION FROM A VIBRATING ELASTIC SPHERE
R. D. Mindlin Jan. 1974 21 p refs
(Contract N00014-67-A-0108-0027; NR Proj. 064-388)
(AD-780244; TR-28) Avail: NTIS CSCL 20/11

When the contribution of the polarization gradient to the stored energy is taken into account, in the theory of elastic dielectrics, there is a small coupling between electromagnetic and elastic energies even in isotropic materials. It is found that the electromagnetic radiation from an isotropic, elastic, dielectric sphere vibrating in its fundamental rotatory mode, with a maximum shear strain of 0.001, is of the order of 10 to the minus 38th power watts - independent of the radius of the sphere and proportional to the square of the strain. Author (GRA)

N74-31637# Naval Underwater Systems Center, New London, Conn.
ELF FIELD STRENGTH MEASUREMENTS MADE IN CONNECTICUT FROM SEPTEMBER 1973 - JANUARY 1974
Peter R. Bannister and Frederick J. Williams 6 May 1974 42 p refs
(AD-779845; NUSC-TR-4719) Avail: NTIS CSCL 17/2

Horizontal magnetic field strength measurements at 42 and 76 Hz were made in Connecticut on a one-week-per-month basis, beginning in September 1973 and extending through January 1974. These measurements are for the purpose of further investigating sunset, nighttime, and seasonal ELF propagation variations. Integration times of 10 to 15 minutes per sample were employed for the majority of the measurements. The

transmission source for these 1.6-Mm measurements was the U.S. Navy ELF Wisconsin Test Facility. The principal results obtained from these measurements were: (1) ELF nighttime propagation is much more variable than daytime propagation, and (2) there may be at least 50 nights each year when the average nighttime field strength will be approximately 3 db lower than on the preceding or following nights. Author (GRA)

N74-31638# Hazeltine Corp., Greenlawn, N.Y.
SYSTEM TRANSVERSAL EQUALIZER Final Report, Apr. 1973 - Jan. 1974
P. Krencik Apr. 1974 35 p refs
(Contract F30602-73-C-0257; AF Proj. 4506)
(AD-781098; RADC-TR-74-49) Avail: NTIS CSCL 17/9

The report describes the implementation, theory of operation, and performance of an adjustable, 48 tap, surface wave transversal equalizer designed for the Rome Air Development Center, Floyd Site Radar. The transversal equalizer achieves equalization of system distortion by an array of fixed taps which provide leading and lagging echoes of the main signal. Equalization is achieved by the introduction of an equal but oppositely phased echo of the main signal. This cancelling echo is continuously adjustable in amplitude and phase by front panel controls. The equalizer is capable of suppressing distortion echoes, having amplitudes up to 15 db below the main signal, to a -40 db level. The sidelobe level reduction applies to all echoes occurring within a 20 microsecond range window. (Modified author abstract) GRA

N74-31639# Hughes Research Labs., Malibu, Calif.
SATELLITE TARGET SIGNATURE STUDY USING CLOSE RANGE MILLIMETER WAVE IMAGING TECHNIQUES Semiannual Technical Report, 1 Apr. - 31 Oct. 1973
J. Mark Baird Dec. 1973 37 p refs
(Contract DAAH01-73-C-0628; ARPA Order 2320)
(AD-780930) Avail: NTIS CSCL 17/9

An experimental design and test setup is described by which 94 GHz images of satellite type targets or portions thereof can be obtained at close range for the purpose of determining the effectiveness of millimeter wavelength range-doppler radar in space object imaging applications. The close range imaging technique uses two parabolic antennas which are both focused at short range on the same target element. These antennas are then mechanically rotated together as a unit so that the rf spot in the target plane is raster scanned over the target. The received signal versus scan position is used to display the target image. First results are expected at the end of 1973. Author (GRA)

N74-31640# Otago Univ., Dunedin (New Zealand). Dept. of Physics.
MAGNETOSPHERE AMPLIFICATION AND DOPPLER SHIFT OF VLF SIGNALS FROM PORT HEIDEN Final Scientific Report, Aug. - Sep. 1972
R. L. Dowden, L. E. S. Amon, and N. R. Thomson 1974 25 p refs
(Contract N00014-73-C-0368)
(AD-780718) Avail: NTIS CSCL 17/2

The article reports a very-low-frequency (VLF) magnetospheric transmission experiment which was conducted between Port Heiden, Alaska and Dunedin, New Zealand during August 1972. GRA

N74-31641# Army Land Warfare Lab., Aberdeen Proving Ground, Md.
EMERGENCY DISTRESS SIGNALLING DEVICE Final Report
C. L. Paxton May 1974 16 p
(AD-780744; LWL-TR-74-62) Avail: NTIS CSCL 17/2

The report describes the development and test of a rocket-launched transmitter/base-station receiver system designed to provide emergency communications capability between isolated patrols and their parent unit up to ranges of 100 miles. Upon receipt of the transmitted signal, the receiver console located at the parent unit base station produces visible and audible output signals which indicate that a specific patrol is in need of assistance. Author (GRA)

N74-31642# Aerospace Corp., El Segundo, Calif.
COMMUNICATION SATELLITES: ISSUES AND TRENDS
I. Bekey 30 May 1974 25 p refs
(Contract F04701-73-C-0074)
(AD-781134; TR-0074(4060-01)-1; SAMSO-TR-74-135) Avail: NTIS CSCL 17/2

The history of development of communications satellites is reviewed, with emphasis on RF power, life, cost, complexity, antenna gain, and ERP trends. Two figures of merit for assessing comparative performance are developed: ERP/weight and ERP x life/weight. These factors are plotted, along with ERP/cost and ERP x life/cost, for several historical Comsats, both commercial and military, and trends are noted toward increasing their performance by means of increasing weight, cost, and complexity. Advances in technology now emerging are reviewed, including items such as multibeam antennas and use of the space shuttle/tug, and conclusions are drawn that such technology can have enormous impact on the performance and cost of future Comsats. A diagram of a possible future Comsat is shown. Author (GRA)

N74-31643# United Aircraft Corp., East Hartford, Conn. Research Labs.
MASTER OSCILLATOR TECHNIQUES FOR 10 MICRON RADAR Final Technical Report, 25 Aug. 1972 - 24 Feb. 1974
A. Stein Apr. 1974 58 p refs
(Contract N00014-73-C-0086)
(AD-778369; UARL-N921512-8) Avail: NTIS CSCL 17/8

The objective of this program was to investigate the feasibility of using electro-optical coupling modulation of a CO2 waveguide laser to obtain a frequency chirped optical signal for application in 10 micron imaging radar. This AM technique combines the advantage of a relatively high modulation efficiency with a wide bandwidth, independent of the gain profile and the free spectral range of the resonator. The use of a wideband waveguide system is for the purpose of displacing the oscillator spectrum relative to the active line of a post-amplifier such that one chirped AM sideband is effectively isolated. (Modified author abstract) GRA

N74-31644# Raytheon Co., Wayland, Mass. Advanced Development Lab.
WIDE-ANGLE LIMITED SCAN ARRAY ANTENNA TECHNIQUES STUDY Final Report, 11 Jun. - 11 Dec. 1973
Chien H. Tang, Ruey. S. Chu, and Charles F. Winter 1 May 1974 102 p
(Contract N00014-73-C-0355)
(AD-780048) Avail: NTIS CSCL 17/9

A duel lens antenna design concept is investigated for the limited electronic scanning for the Range Instrumentation Radar Application. The antenna is to perform simultaneous monopulse angle tracking on multiple targets. The design goal for the antenna is a scan area of plus or minus 10 degrees in elevation and plus or minus 20 degrees in azimuth. The antenna beamwidth is specified at 1 degree. Based on an extensive trade-off study, an antenna configuration that satisfies the above requirements is selected. The antenna is a telescope-like structure which has an aperture of 11.4 min. The length to diameter ratio of the overall antenna dimension is estimated to be 2. The selected antenna configuration has been evaluated analytically. The design is believed to be a viable one and no insurmountable difficulty in fabricating the antenna has been found. The originally anticipated advantages of the antenna configuration, such as no blockage, minimum aperture size requirement, wide scan angle, small number of required phase shifters and good pattern control, are still intact. Encouraged by the computed results, an antenna hardware definition study for the antenna system cost estimate is recommended. Author (GRA)

N74-31645# Michigan Univ., Ann Arbor. Radiation Lab.
MATHEMATICS OF GUIDED WAVE PROPAGATION IN OPEN STRUCTURES Final Report
Chiad-Min Chu May 1974 48 p refs
(Grant AF-AFOSR-2538-73)
(AD-781076; UMICH-011778-1-F) Avail: NTIS CSCL 20/14

The propagation of electromagnetic waves along open structures whose transverse cross section are composed of two

symmetrically placed circular sectors is investigated. The problem is first formulated in the form of a dual summation equation. By introducing a new set of basis functions to represent the surface field, the dispersion relation for such a structure is developed, systematic techniques of finding the approximate solutions of the dispersion relation are formulated, and numerical solutions for the first two orders of approximation are carried out to illustrate the feasibility of using the technique. (Modified author abstract) GRA

N74-31646# Inter-Range Instrumentation Group, White Sands Missile Range, N.Mex.
TELEMETRY STANDARDS, REVISED MAY 1973
1973 104 p refs
(AD-780868; IRIG-106-73) Avail: NTIS CSCL 09/6

The Telemetry Group of the Range Commanders Council (RCC) prepared the document of standards to foster the compatibility of telemetry transmitting, receiving, and signal processing equipment at all the Test and Evaluation (T-E) ranges under the cognizance of the RCC. The standards provide development and coordination agencies with the necessary criteria on which to base equipment design and modification. The ultimate purpose is to ensure efficient spectrum utilization and interference-free operation of the radio link for telemetry systems at the RCC member ranges. GRA

N74-31674 Royal Aircraft Establishment, Farnborough (England).
RADIATION CHARACTERISTICS OF HF NOTCH AERIALS INSTALLED IN SMALL AIRCRAFT
N. A. D. Pavey *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)

N74-31683 Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
CROSS-POLARISED RADIATION FROM SATELLITE REFLECTOR ANTENNAS
A. W. Rudge, T. Pratt, and A. Fer *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

N74-31690 EMI Electronics Ltd., Feltham (England).
UPPER L-BAND TELEMETRY AERIALS FOR ROCKETS AND MISSILES
J. Mahoney *In* AGARD Antennas for Avionics Jun. 1974 17 p refs (For availability see N74-31667 21-09)

N74-31692 AEG-Telefunken, Ulm (West Germany).
ANALYSIS OF FINITE ARRAYS OF RECTANGULAR APERTURES ON CONDUCTING ELECTRIC COATED CYLINDERS
J. Vogt *In* AGARD Antennas for Avionics Jun. 1974 7 p refs (For availability see N74-31667 21-09)

N74-31695* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL FREQUENCY DICHROIC FEED PERFORMANCE
D. A. Bathker *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)
(Contract NAS7-100)
CSCL 17B

N74-31696 Siemens A.G., Munich (West Germany). Zentrallab. fuer Nachrichtentechnik.
EMPLOYMENT OF NEARFIELD CASSEGRAIN ANTENNAS WITH HIGH EFFICIENCY AND LOW SIDELOBES, TAKING THE INTELSAT-GROUND STATIONS AND THE GERMAN HELIOS-TELECOMMAND STATION AS EXAMPLES
Uwe Leupelt and Wolfgang Rebhan *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)

N74-31699 Royal Aircraft Establishment, Farnborough (England).
NOTES ON THE RADIATION PATTERNS OF HF AERIALS INSTALLED ON HELICOPTERS
W. T. Blackband *In* AGARD Antennas for Avionics Jun. 1974 6 p (For availability see N74-31667 21-09)

N74-31700 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
RADIATION CHARACTERISTICS OF THINNED ARRAY ANTENNAS
W. Soentgerath *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)

N74-31701 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
IN-FLIGHT MEASUREMENT OF AIRCRAFT ANTENNAE RADIATION PATTERNS
Helmut Bothe *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

N74-31702 Naval Research Lab., Washington, D.C.
DYNAMIC MEASUREMENT OF AVIONIC ANTENNAS
I. D. Olin and E. E. Maine, Jr. *In* AGARD Antennas for Avionics Jun. 1971 14 p refs (For availability see N74-31667 21-09)

N74-31703 Technische Hochschule, Aachen (West Germany).
AN IMPROVED MEASURING TECHNIQUE FOR INVESTIGATIONS OF THE NEAR FIELD REGION OF ANTENNAS
Ruediger Anders *In* AGARD Antennas for Avionics Jun. 1974 8 p refs (For availability see N74-31667 21-09)

N74-31704 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
DETERMINATION OF THE MOVEMENT OF THE APPARENT PHASE CENTERS OF AIRCRAFT ANTENNAS FOR CALIBRATING THE ZDBS INTERFEROMETER
A. Ischrott and S. Modabber *In* AGARD Antennas for Avionics Jun. 1974 26 p refs (For availability see N74-31667 21-09)

N74-31705 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
OFF-BORESIGHT ANGLE ESTIMATION WITH A PHASE COMPARISON MONOPULSE SYSTEM
W. Sander *In* AGARD Antennas for Avionics Jun. 1974 13 p refs (For availability see N74-31667 21-09)

N74-31706* Ohio State Univ., Columbus. ElectroScience Lab.
ROLL PLANE ANALYSIS OF ON-AIRCRAFT ANTENNAS
W. D. Burnside, R. J. Marhefka, and C. L. Yu *In* AGARD Antennas for Avionics Jun. 1974 23 p refs (For availability see N74-31667 21-09)
(Grant NGR-36-008-144)
CSCL 17B

N74-31818 Stevens Inst. of Tech., Hoboken, N.J.
INTRODUCTORY SURVEY TO SESSION ON PARAMETRIC INSTABILITIES, LABORATORY EXPERIMENTS AND THEORY
George Schmidt *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 5 p refs Sponsored in part by AEC (For availability see N74-31812 21-13)

N74-31829 King's Coll., London (England). Dept. of Mathematics.
A SELF CONSISTENT THEORY OF TRIGGERED VLF EMISSIONS
D. Nunn and M. J. Rycroft (Southampton Univ., England) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 15 p refs (For availability see N74-31812 21-13)

N74-31830 Comissao de Etudos da Energia Nuclear, Lisbon (Portugal). Inst. Superior Tecnico.
WHISTLER TRIGGERED EMISSIONS
A. L. Brinca *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 11 p refs (For availability see N74-31812 21-13)

N74-31831 Newcastle-upon-Tyne Univ. (England). Dept. of Engineering Mathematics.
NONLINEAR WAVE MODULATION OF WHISTLER WAVES
Masayoshi Tajiri *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 11 p refs (For availability see N74-31812 21-13)

N74-31832 Istituto Nazionale di Geofisica, Rome (Italy). Ionospheric Dept.
NONLINEAR MAGNETOIONIC EFFECTS IN THE MAGNETOGUIDING OF WHISTLERS
P. Dominici *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 3 p refs (For availability see N74-31812 21-13)

N74-31834 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
NARROWBAND RADIO NOISE IN THE TOPSIDE IONOSPHERE
H. G. James, E. L. Hagg, and D. L. P. Strange *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 18 p refs (For availability see N74-31812 21-13)

N74-31835 Norwegian Inst. for Air Research, Kjeller.
RESONANCE PHENOMENA OBSERVED ON MOTHER-DAUGHTER ROCKET FLIGHTS IN THE AURORAL IONOSPHERE
K. Folkestad and J. Troim *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 15 p refs (For availability see N74-31812 21-13)

N74-31837 SIGMA Association, Hamburg (West Germany).
RESONANCE FREQUENCY OF AN IONIZED LAYER IN DEPENDENCE ON LAYER THICKNESS
C. Fengler *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 6 p refs (For availability see N74-31812 21-13)

N74-31840 Pennsylvania State Univ., University Park. Ionosphere Research Lab.
WAVE INTERACTION USING A PARTIALLY REFLECTED PROBING WAVE
W. A. Kissick and A. J. Ferraro *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 9 p refs (For availability see N74-31812 21-13)
(Contract N00014-67-A-0385-0014; Grant NSF GA-13885)

N74-31843 Camerino Univ. (Italy).
NUMERICAL SOLUTION OF A PROBLEM OF NONLINEAR WAVE PROPAGATION THROUGH PLASMAS
L. M. DeSocio and G. Gaffuri *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 10 p refs (For availability see N74-31812 21-13)

N74-31844 Naples Univ. (Italy). Centro Studi di Radiopropagazione.
THE IONOSPHERIC PROPAGATION OF THE MODULATED WAVES WITH CARRIER FREQUENCIES FAR FROM AND VARYING AROUND THE GYROFREQUENCY
M. Cutolo, P. DiMaio, G. Gaffuri, G. Agnelli (Osservatorio Astronomico di Rome, Italy), F. Fabbri (Osservatorio Astronomico di Rome, Italy), M. Iannello (Osservatorio Astronomico di Rome, Italy), R. Flagg (Florida Univ.), and W. Greenman (Florida Univ.) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 13 p refs (For availability see N74-31812 21-13)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-31647*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A STUDY OF THREE FINITE DIFFERENCE SCHEMES AND THEIR ROLE IN ASYNOPTIC METEOROLOGICAL DATA ASSIMILATION
Isidore Halberstan [1973] 42 p refs Submitted for publication
(Grants NGR-33-008-191; NGL-33-016-013)
(NASA-TM-X-70320) Avail: NTIS HC $5.25 CSCL 05B

An investigation of three finite difference methods and their responses to the insertion of simulated satellite data is presented. A simple-one-level barotropic model is used as the forecast model, while the Mintz-Arakawa two-layer model is used to furnish the initial field, the verification fields, and the simulated satellite data. The schemes tested are the Shuman, the Matsuno-TASU, and an implicit scheme devised by McPherson. Results indicate that the schemes react to inserted data as they would react to unfiltered initial fields. Schemes which contain significant implicit viscosity are capable of damping the high frequency oscillations which occur after insertions, but such schemes may cause a loss of information. Schemes which contain less damping capability produce shock waves which damage the forecasts. It is also found that insertion of winds along with temperature data improves the forecast considerably. Author

N74-31648# Joint Publications Research Service, Arlington, Va.
ALL-UNION RADIO DAY SCIENTIFIC MEETING, ANNOTATIONS AND TOPICS OF REPORTS
31 Jul. 1974 102 p refs Transl. into ENGLISH from Vsesoyuznaya Nauchnaya Sessiya, Posvyashcennaya Dnyu Radio--Annotatsii i Tezisy Dokladov (Moscow), 1974 p 1-80 (JPRS-62609) Avail: NTIS HC $8.25

Abstracts on electronics, microelectronics, and semiconductors devices are reported. Radio measurements, and the application of radioelectronics in biology and medicine are presented. Author

N74-31649# Joint Publications Research Service, Arlington, Va.
SCIENTIFIC MEETING ON ALL-UNION RADIO DAY, ANNOTATIONS AND TOPICS OF REPORTS
31 Jul. 1974 118 p refs Transl. into ENGLISH from Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio, Annotatsii i Tezisy Dokladov (Moscow), 1974 p 1-84
(JPRS-62616) Avail: NTIS HC $9.00

Abstracts are reported on analog computer engineering and electronic computer engineering. An information systems design is discussed along with automatic switching and communication networks. Author

N74-31650# National Bureau of Standards, Washington, D.C. Systems and Software Div.
CONCEPTS IN QUALITY SOFTWARE DESIGN Interim Report
S. L. Stewart, ed. Aug. 1974 89 p refs
(NBS Proj. 6401121)
(NBS-TN-842; LC-74-600130) Avail: SOD HC $1.25 as C13.46:842

Edited notes from a seminar on quality software are presented. Data cover software quality, top down programming, powers of structured control constructs, elements of good and bad programming, and proof of correctness techniques. Program synthesis was also examined. For individual titles, see N74-31651 through N74-31655.

N74-31651 Johns Hopkins Univ., Baltimore, Md.
PERSPECTIVES ON QUALITY SOFTWARE
S. Rao Kosaraju and Henry F. Ledgard *In* NBS Concepts in Quality Software Design Aug. 1974 p 1-17 (For availability see N74-31650 21-08)

A brief background provides motivation for studies in software quality. Some factors which influence software manufacture are mentioned, and measures which might quantify concepts of software quality are proposed. Several approaches to establishing program correctness receive attention. Observations on software production management are included. Author

N74-31652 Massachusetts Univ., Amherst.
THE CASE FOR TOP-DOWN PROGRAMMING
Henry F. Ledgard *In* NBS Concepts in Quality Software Design Aug. 1974 p 18-32 (For availability see N74-31650 21-08)

Elements of top-down programming are sketched out and then examined. An extended critique of another top-down experiment is included as sample material. Author

N74-31653 Johns Hopkins Univ., Baltimore, Md.
STRUCTURED PROGRAMS
S. Rao Kosaraju *In* NBS Concepts in Quality Software Design Aug. 1974 p 33-45 (For availability see N74-31650 21-08)

Powers of various structured control constructs are compared

within a framework of weak and strong program equivalence. Results include a demonstration that Dijkstra's D-programs are strongly equivalent to programs built from functions and one-input/two-input predicates. Author

N74-31654 Massachusetts Univ., Amherst.
TOWARDS A FORMALIZATION FOR QUALITY SOFTWARE
Henry F. Ledgard *In* NBS Concepts in Quality Software Design Aug. 1974 p 46-65 (For availability see N74-31650 21-08)

After a review of Quine's notion of referential transparency, elements of good and bad programming practice are examined. A series of examples demonstrate various points. In addition, a table of programming proverbs provides guidance to a programmer, and should be especially useful to a novice. Author

N74-31655 Johns Hopkins Univ., Baltimore, Md.
CORRECTNESS OF PROGRAMS: WRITING CORRECT PROGRAMS
S. Rao Kosaraju *In* NBS Concepts in Quality Software Design Aug. 1973 p 66-79 (For availability see N74-31650 21-08)

Discussions on problem and program specification provide an introduction to a review of proof-of-correctness techniques. Then, noting some practical limitations on proof-of-correctness, selected facets of program synthesis, were examined. Author

N74-31656*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENHANCING SIMULATION OF EFFICIENCY WITH ANALYTICAL TOOLS
S. M. Seltzer 15 Jun. 1974 24 p refs
(NASA-TM-X-64867) Avail: NTIS HC $3.00 CSCL 09B

Some means of combining both computer simulation and anlytical techniques are indicated in order to mutually enhance their efficiency as design tools and to motivate those involved in engineering design to consider using such combinations. While the idea is not new, heavy reliance on computers often seems to overshadow the potential utility of analytical tools. Although the example used is drawn from the area of dynamics and control, the principles espoused are applicable to other fields. In the example the parameter plane stability analysis technique is described briefly and extended beyond that reported in the literature to increase its utility (through a simple set of recursive formulas) and its applicability (through the portrayal of the effect of varying the sampling period of the computer). The numerical values that were rapidly selected by analysis were found to be correct for the hybrid computer simulation for which they were needed. This obviated the need for cut-and-try methods to choose the numerical values, thereby saving both time and computer utilization. Author

N74-31657*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DESIGN, TESTING AND OPERATION OF THE IUE DATA PROCESSING UNIT POWER SUPPLY
Joseph A. Gillis, Jr. Jul. 1974 34 p
(NASA-TM-X-70724; X-711-74-219) Avail: NTIS HC $4.75 CSCL 09B

The design and operation is reported of the power supply for the IUE data processing unit. Design specifications are presented along with performance data and parts selection. Illustrations show the completed circuit with and without its covers. M.C.F.

N74-31658*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A BRIEF DESCRIPTION OF THE MEDICAL INFORMATION COMPUTER SYSTEM (MEDICS)
Edward C. Moseley Aug. 1974 23 p refs
(NASA-TM-X-58138; JSC-09080) Avail: NTIS HC $3.00 CSCL 09B

The Medical Information Computer System (MEDICS) is a time shared, disk oriented minicomputer system capable of meeting storage and retrieval needs for the space- or non-space-related applications of at least 16 simultaneous users. At the various commercially available low cost terminals, the simple command and control mechanism and the generalized communication activity of the system permit multiple form inputs, real-time updating, and instantaneous retrieval capability with a full range of options. Author

N74-31659# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
TECHNIQUES FOR THE PROCESSING, STORAGE, AND EXCHANGE OF DATA
Roy L. Jenne and Dennis H. Joseph Jan. 1974 51 p refs
(NCAR-TN/1A-93) Avail: NTIS HC $5.75

Data processing procedures and computer subroutines are presented to help make data exchange more practical. Computer hardware systems are reported with considerations for choosing data formats. Also included are guidelines for exchanging data between computers. M.C.F.

N74-31660*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-F/GEOS-C SATELLITE TO SATELLITE TRACKING DATA PROCESSING CONSIDERATION
J. W. Bryan May 1974 20 p refs
(NASA-TM-X-70736; X-932-74-146) Avail: NTIS HC $4.00 CSCL 05B

The satellite to satellite tracking data unique processing considerations are presented. The strategy to be employed in the application of data processing routines to the ATS-F/GEOS-C satellite to satellite tracking experiment is described. When these considerations are included, studies, analysis and simulations predict an orbital position uncertainty of less than 15 meters and a velocity uncertainty of less than 1.5 millimeters per second. Author

N74-31661# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PHOTOGRAPHIC EXPERIMENT DATA REDUCTION: PROCESSING SYSTEM CONFIGURATION [DEPOUILLEMENT DES EXPERIENCES PHOTOGRAPHIQUES: CONFIGURATION DU SYSTEME DE TRAITEMENT]
A. Rabearivelo [1973] 14 p In FRENCH
(CALC-10-72) Avail: NTIS HC $4.00

A discussion of the technical requirements for the photographic data processing system to be installed at the French Laboratory of Spatial Astronomy is presented. Various alternatives are proposed with regard to microphotometer, pilot unit and keyboard, buffer memory, interfaces, storage medium, processing speed, and I/O devices. ESRO

N74-31662# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PHOTOGRAPHIC EXPERIMENT DATA REDUCTION. ACQUISITION SYSTEM [DEPOUILLEMENT DES EXPERIENCES PHOTOGRAPHIQUES: SYSTEME D'ACQUISITION]
A. Rabearivelo 30 Nov. 1972 8 p In FRENCH
(CALC-11-72) Avail: NTIS HC $4.00

A discussion on economics, budgeting, and priorities for the photographic data processing system at the French Laboratory of Spatial Astronomy, is presented. The needs of the FAUST experiment and the Skylab program experiment S183 are compared, and various solutions are proposed. ESRO

N74-31663# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PHOTOGRAPHIC EXPERIMENT DATA REDUCTION: ACQUISITION AND PREPROCESSING SYSTEM [DEPOUILLEMENT DES EXPERIENCES PHOTOGRAPHIQUES: SYSTEME D'ACQUISITION ET DE PRETRAITEMENT]
A. Rabearivelo 19 Mar. 1973 12 p In FRENCH
(CALC-04-73) Avail: NTIS HC $4.00

A proposal for data acquisition from photographs (mainly from experiment S183 of the Skylab program) is presented. The various components of the system are reviewed with regard to the microphotometer (photometric data system 1010A), the computer (PDP 11/40), the various interfaces, such as A/D converter, motor control, and coordinate measurement system, the video console (IMLAC PDS 1D), the cassette-tape reader, and the disks. The system may be operated in a variety of modes amongst which emphasis is placed on real time preprocessing (compression), data acquisition, and data exploitation. ESRO

N74-31664# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Section.
STUDY OF SOME PROBLEMS OF TRANSFORMATION OF POTENTIAL FIELDS
M. A. Aleksidze, M. S. Gelashvili, and K. M. Kartvelishvili Feb. 1974 289 p refs Transl. into ENGLISH of the book "Issledovanie Nekotorykh Voprosov Transformatsii Potentsialnykh", USSR, Tiflis, 1972 284 p
(AD-779843; DMAAC-TC-1987) Avail: NTIS CSCL 08/5

The monograph gives a complete exposition of three methods of transforming potential fields, and in each case algorithms are presented for working them on general-purpose digital computers. For two of them the corresponding universal programs are also provided, one of which is written in M-220 machine code, and the other in the algorithmic language ALGOL-60. GRA

N74-31665# Analysis and Computer Systems, Inc., Burlington, Mass.
DEVELOPMENT OF COMPUTER-ORIENTED MATHEMATICAL METHODS FOR CLIMATOLOGICAL, ATMOSPHERIC AND CRYSTAL STUDIES Final Report, 1 Mar. 1971 - 28 Feb. 1974
Arthur Abelowitz, Donald J. Armstrong, James F. Atkinson, Edward D. Conway, Robert T. Delmonico, Peter W. Lindstrom, and David Stoll Mar. 1974 149 p refs
(Contract F19628-71-C-0124)
(AD-781171; AFCRL-TR-74-0170) Avail: NTIS CSCL 09/2

The report summarizes the work effort performed under the contract. During the three years covered by the report, over one hundred programs were completed ranging in complexity and size from conversion of programs from one language or computer system to another, to analysis and development of a large system of analytical programs operating in a real time environment. The mathematical and computer techniques developed under this contract supported AFCRL research projects in such areas as: Climatology, Meteorology, Microwave Acoustics, Ionospheric Physics, Plasma Physics and Radio Astronomy. A sampling of these projects are outlined in the report. (Modified author abstract) GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-31666*# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
DEVELOPMENT OF AN IMAGE CONVERTER OF RADICAL DESIGN Final Report
E. L. Irwin and D. L. Farnsworth Jul. 1972 231 p
(Contract NAS8-5112)
(NASA-CR-120350; WEC-72-0581A) Avail: NTIS HC $14.75 CSCL 09E

A long term investigation of thin film sensors, monolithic photo-field effect transistors, and epitaxially diffused phototransistors and photodiodes to meet requirements to produce acceptable all solid state, electronically scanned imaging system, led to the production of an advanced engineering model camera which employs a 200,000 element phototransistor array (organized in a matrix of 400 rows by 500 columns) to secure resolution comparable to commercial television. The full investigation is described for the period July 1962 through July 1972, and covers the following broad topics in detail: (1) sensor monoliths; (2) fabrication technology; (3) functional theory; (4) system methodology; and (5) deployment profile. A summary of the work and conclusions are given, along with extensive schematic diagrams of the final solid state imaging system product. A.A.D.

N74-31667# Advisory Group for Aerospace Research and Development, Paris (France).
ANTENNAS FOR AVIONICS
Jun. 1974 526 p refs In ENGLISH and partly in French Presented at the 26th meeting of the Avionics Panel Symp., Munich, 26-30 Nov. 1973
(AGARD-CP-139) Avail: NTIS HC $29.50

The application of avionics antennas in Aerosat systems is considered by analyzing the feasibility of realizing required radiation patterns either on the aircraft, on the satellite, or on the ground. For individual titles, see N74-31668 through N74-31708.

N74-31668 Naval Electronics Lab. Center, San Diego, Calif.
CONFORMAL ARRAYS FOR AIRCRAFT
J. Provencher, J. Boyns, and A. Hessel (Polytechnic Inst. of New York) *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)

Design consideration involved with the multifrequency conformal array are: (1) element pattern effects in non-planar arrays; (2) multifrequency array techniques; and (3) MIC components and cost considerations. The element patterns of conical arrays are examined to determine if behavior is similar to known element patterns for the cylindrical or planar arrays, and a conical sector experimental array is used to simulate selected scanned beam positions to determine array behavior, i.e., beamwidth, scan limits, polarization and side lobe level. The concept of the multifrequency array has been shown to be feasible, and the use of the interlacing technique with the conformal array allows more flexibility due to the larger element spacing possible. These features, combined with MIC hybrid matrix techniques for multiple beams, diode phasors and hybrid drivers for beam steering, and flush mounted radiating elements provide the system designer with a versatile antenna system. Prototype arrays designed at wavelengths of 30cm, 10cm, 7cm and 3cm are described. Author

N74-31669 Naval Research Lab., Washington, D.C. Radar Div.
PATTERNS AND POLARIZATIONS OF SIMULTANEOUSLY EXCITED PLANAR ARRAYS ON A CONFORMAL SURFACE
J. K. Hsiao and A. G. Cha *In* AGARD Antennas for Avionics Jun. 1974 16 p refs (For availability see N74-31667 21-09)

A conformal array on a surface of small curvature can be approximated by a number of planar arrays, several of which may be excited simultaneously so as to achieve a performance similar to that of a conformal array. Since the main beam of a planar array can be steered to any direction in visible space, several arrays, each oriented in a different direction, can be steered cooperatively to form a single beam in a desired direction. A general formulation of the radiated field of such an array of arrays is developed with the aid of formulas which relate the components into which a vector is resolved in one orthogonal coordinate system with those into which the same vector is resolved in a second orthogonal coordinate system. Using this formulation, it can be shown that within each array, the conventional row and column phase setting can be used. As examples, the radiation patterns and polarizations of multiple arrays of short dipoles are studied using the present formulation. A comparison of the multiple planar array with the conventional conformal array is also presented. Author

N74-31670 Terma Elektronisk Industri A/S, Aarhus (Denmark).
DESIGN OF PERIODICALLY MODULATED TRI-PLATE ANTENNAS
Finn Laursen *In* AGARD Antennas for Avionics Jun. 1974 6 p refs (For availability see N74-31667 21-09)

A new configuration of periodically modulated traveling wave tri-plate antennas has been developed. The physical complexity of this new configuration implies that sufficiently accurate design data are extremely difficult to predict by any known analytical methods. Three different measuring methods to achieve experimental design data are discussed. The far field method, which has been further developed during this investigation, the near field method, and the insertion loss method. The most appropriate combination of the three methods is used to find the design data. An X-band antenna array is designed and discussed. The new structure is mechanically simple, it has good impedance characteristics, allows good control of the aperture illumination, and radiates a linear polarized field with a very low cross polarized component. Author

N74-31671 Ferranti, Ltd., Edinburgh (Scotland).
HIGH EFFICIENCY ANTENNAS FOR AIRBORNE RADAR
R. W. Forrester and A. J. Lait *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

Consideration is given to antenna types which are suitable for use in airborne radars, and their advantages and disadvantages discussed. Several important antenna properties are efficiency, sidelobe level, scanning rate, weight, cost, etc. Emphasis is concentrated on methods which give a high antenna efficiency, whilst trying to maintain as many of the other properties as possible. An experimental Cassegrain antenna has been designed and built. It employs energy redistribution techniques to give a high efficiency, whilst retaining a reasonable sidelobe level. A measured efficiency of 70% was obtained at the design frequency, which only dropped to 65% at 500 MHz above design frequency. The antennas gave good sum and difference patterns over a 2 GHz band in X-band. Author

N74-31672 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
SHF HIGH POWER AIRBORNE COMMUNICATIONS ANTENNA
J. P. Grabowski and F. L. Lanphear *In* AGARD Antennas for Avionics Jun. 1974 12 p refs (For availability see N74-31667 21-09)

The high power SHF antenna, which is mounted atop the fuselage of a KC-135 aircraft, is part of a link which permits communication between tactical terminals by means of a synchronous altitude satellite. The antenna can acquire and track a satellite beacon signal, hold a stable line of sight for a short period of time, and is capable of being computer pointed. The antenna configuration was specifically designed for handling high CW power levels at X-band frequencies without the use of forced air or liquid cooling. A 32-inch Cassegrain antenna system was selected to provide a minimum antenna gain of 32.5 db over a 6% transmit frequency band and a separate 6% receive frequency band. The antenna radiates a right hand circularly polarized signal at a CW power level of 12.5 kW and simultaneously receives left hand circularly polarized signals. Computations utilizing measured antenna patterns indicate the antenna noise temperature to be 84 K. The feedhorn is a simple conical horn aperture operating in the dominant mode. A 2-mil H-film aperture window serves as the feed radome and pressure barrier. Compactness is achieved in the feed design by incorporating a circularly polarized dual mode transducer which generates the required senses of circular polarization and at the same time provides the duplexing between the transmit and receive signals. Author

N74-31673 Elecma, Suresnes (France).
PROBLEMS OF ANTENNAS OPERATING IN THE TELEMETRIC S BAND REGION [PROBLEMES D'ANTENNES POSES PAR LE PASSAGE EN BANDE 5 DES TELEMESURES]
M. Nicolas and C. Mast *In* AGARD Antennas for Avionics Jun. 1974 13 p In FRENCH (For availability see N74-31667 21-09)

Principles of ground antennas, noting S band and automatic tracking are given along with design examples. The antennas are of the parabolic reflector type with a monopulse source. The separate signals are treated as a function of composite analog signals generated and delivered by a conical sweeping arrangement. An example was also given of a ground antenna simultaneously receiving in two bands, S and VHF.
Transl. by E.H.W.

N74-31674 Royal Aircraft Establishment, Farnborough (England).
RADIATION CHARACTERISTICS OF HF NOTCH AERIALS INSTALLED IN SMALL AIRCRAFT **c07**
N. A. D. Pavey *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)

The radiation characteristics of HF notch aerials in small aircraft are analyzed for the band 2 to 10 MHz. Radiation occurs in two main modes; a magnetic dipole mode resulting from the high local RF currents flowing around the notch, and an electric dipole mode resulting from longitudinal RF currents in the fuselage. A procedure is given for the estimation of the radiation efficiency of an aircraft notch aerial. It is shown that high radiation efficiencies may be realized at frequencies near the aircraft electrical resonance, typically 10 MHz, but that a rapid reduction of radiation efficiency occurs at lower frequencies. A radiation efficiency of less than 0.1% at 2 MHz is to be expected for many aircraft notch serials. Author

N74-31675 Collins Radio Co., Cedar Rapids, Iowa. Telecommunications Equipment Div.
HF ANTENNA SYSTEMS FOR SMALL AIRPLANES AND HELICOPTERS
R. E. Deasy *In* AGARD Antennas for Avionics Jun. 1974 18 p (For availability see N74-31667 21-09)

Basic information is presented to help antenna designers and installers provide optimum HF antenna systems on small airplanes and helicopters. Discussion involves practical antenna installation considerations rather than detailed antenna theory. Wire, shunt/notch, and tuned monopole types of antennas and associated antenna couplers are discussed. Important details related to the selection, installation, and successful operation of these antenna systems are given. Typical antenna location, size, and configuration are related to aircraft characteristics. Three common forms of wire antennas (long wire, inverted V, and short grounded wire) are illustrated. Techniques such as RF grounding, bonding, and shielding to eliminate RFI are discussed in detail. Shielded antenna feedline techniques (including efficiency considerations) are shown. Voltage-altitude design considerations are given. Shunt and notch type antennas are illustrated and general details of location, size, and construction are discussed. A typical installation is detailed showing RFI considerations. A tuned monopole (with load wire) antenna is discussed for applications on small airplanes and helicopters. Typical installation guidelines are given along with details showing RFI considerations. Author

N74-31676 MEL Equipment Co., Ltd., Crawley (England).
VERY SLIM, HIGH GAIN PRINTED CIRCUIT MICROWAVE ANTENNA FOR AIRBORNE BLIND LANDING AID
W. Hersch *In* AGARD Antennas for Avionics Jun. 1974 2 p (For availability see N74-31667 21-09)

A very slim stripline microwave antenna designed for C - Band consists basically of two selectively etched POLYGUIDE boards. The integral radiating elements are 2 stacked dipoles, backed by a reflector, yielding a cardioid shaped beam approximately 40 degrees wide. An aerodynamically shaped radome and the use of high temperature materials makes this antenna suitable for all supersonic aircraft. Author

N74-31677 Marconi-Elliott Avionic Systems Ltd., Borehamwood (England).
POLYROD AERIALS FOR AVIONIC APPLICATIONS
M. Scorer and A. M. Smith *In* AGARD Antennas for Avionics Jun. 1974 13 p refs (For availability see N74-31667 21-09)

The effect of adding rectangular dielectric slabs, having cross sections of the order of tens of square wavelengths, to the aperture of an aerial is studied with a view to increasing its gain. A theory has been developed to describe the performance of such an aerial and has been verified experimentally. Theoretical and experimental curves of gain enhancement versus slab length for slabs having various dielectric constants are presented. Hybrid slabs, comprising sections of different dielectric constants, have been designed according to the theory and show improved performance over slabs of constant dielectric constant. Slabs excited by feeds whose apertures have cross sections smaller than the slab cross section have also been examined. Author

N74-31678 Royal Radar Establishment, Malvern (England).
LINEAR PHASED ARRAY FOR YAW STABILISATION
D. S. Hicks *In* AGARD Antennas for Avionics Jun. 1974 14 p refs (For availability see N74-31667 21-09)

The theoretical performance of a linear digital phased array with both equal and unequal interelement spacing has been investigated with the aid of a computer program written in ALGOL 68R. Three aerials have been studied. The first is a conventional linear phased array in which each element consists of a waveguide horn. The elements are placed side by side to form a fully filled aperture. The other two arrays consist of identical waveguide horn elements but the spacing is not equal. Two arbitrarily chosen spacing laws were studied each of which had an exponential form. The loss in gain due to phase quantization has been calculated and the effects of the unequal inter-element

spacing law on gain and beamwidth is estimated. The beam pointing error, the beam granularity and the magnitude of the peak sidelobes are presented here for the three arrays. It is shown that some reduction in the number of elements required to fabricate an array may be achieved if the inter-element spacing is not made equal, the magnitude of the grating lobes may be significantly reduced if the spacing law is chosen correctly. Lastly a simple means by which a static split system may be achieved is discussed and some simulation program results presented.
Author

N74-31679 Naval Research Lab., Washington, D.C.
AEW RADAR ANTENNAS
Tomos Llewelyn apRhys and Grealie Anderson Andrews, Jr. *In* AGARD Antennas for Avionics Jun. 1974 17 p refs (For availability see N74-31667 21-09)

It is shown that the single most important factor influencing the ability of the AEW radar system to operate is the antenna's sidelobe performance. In general, this sidelobe performance is dominated by the airframe on which it is mounted. Careful design is needed, considering both aerodynamic as well as electrical aspects, before an overall optimal system configuration can be determined. Once this antenna sidelobe performance has reached an acceptable level, it is then found that the next limitation is that due to errors in the compensation of platform motion. Recent advances in digital processing technique offer many advantages in connection with moving-target indication (MTI) but these can only be realized when the platform-motion compensation is sufficiently accurate. The various system considerations governing this performance are discussed and the requirements reflecting on the antenna performance described in detail.
Author

N74-31680 Chelton (Electrostatics) Ltd., Marlow (England).
AIRBORNE LOW-VHF ANTENNAS
Charles E. Cooper *In* AGARD Antennas for Avionics Jun. 1974 8 p (For availability see N74-31667 21-09)

A blade type antenna design is considered for airborne transmission and reception, with variants covering major sections of the overall frequency band from 26 to 100 MHz. It uses miniature high vacuum relays to tune via pre-selection of up to six binary related inductors, providing up to sixty four tuning combinations, with individual band widths varying from about + or - 0.5 to 5.0 MHz. The relays are remotely controlled either manually or automatically, and the retune process can be virtually instantaneous upon both receive and ready to transmit modes, without having to be incepted by any period of transmission. Incorporation of a variable tuning system was compelled by the specified combination of total frequency coverage and maximum allowable dimensions for the antenna. However, experimental investigations into the practical limits of broadbanding produced an antenna design fixed tuned to cover 38 to 46 MHz, which is briefly described. A brief outline of a wideband VHF homing antenna which uses elements formed out of transparent metallic-film depositions upon the acrylic canopy of the Gazelle helicopter is included.
Author

N74-31681 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Lab. du DERMO.
TE SUB 11 CIRCULAR WAVEGUIDE FERRITE PHASERS OPTIMIZATION
A. M. Dupvtz and A. C. Priou *In* AGARD Antennas for Avionics Jun. 1974 16 p refs (For availability see N74-31667 21-09)

An exact analytical and numerical method has been elaborated for the complete determination of the propagating modes in a reduced size circular TE 1 waveguide partially or fully filled with a lossy axially partially magnetized ferrite rod. Computed results at 17 GHz and 9.5 GHz are presented which allow for optimization of circulary polarised phasers such as Dual Plode Phasers (D.M.P.) or Polarization Insensitive Phasers (P.I.P.).
Author

N74-31682 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
A CROSSED-SLOT BELT ARRAY ANTENNA FOR SATELLITE APPLICATION
R. Breithaupt, B. Clarke, and D. Waung *In* AGARD Antennas for Avionics Jun. 1974 14 p refs (For availability see N74-31667 21-09)

A partially complete feasibility study of the design and fabrication of a fixed beam, circular-polarized belt array for possible use as a telemetry/command antenna on a geostationary communications satellite, is described. This application requires a toroid shaped coverage pattern for use when the satellite is not oriented on station. The belt array of circular-polarized elements used is fed using travelling wave excitation by a thin plated dielectric waveguide of .060 in. x 2.350 in. cross section. After some measurements on round hole radiating elements, crossed slots with external dielectric loading were finally chosen. These elements were matched and characterized in terms of scattering parameters in an active array environment. Measured performance of this array was less than expected due to significant effects of tolerance and placement of the external dielectric loading on individual elements.
Author

N74-31683 Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
CROSS-POLARISED RADIATION FROM SATELLITE REFLECTOR ANTENNAS c07
A. W. Rudge, T. Pratt, and A. Fer *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

The limited RF spectrum which is available for satellite communication systems has led to increased interest in the use of dual polarized and orthogonally polarized multiple beam antennas. Since an accurate knowledge of the antenna sidelobes and cross polarized radiation is necessary to ensure adequate isolation between RF channels, this paper examines some available techniques which can be employed to predict the vector fields of reflector antennas. The problem of providing an adequate description of the antenna primary feed radiation is found to be a critical factor. Results for predicted and measured cross polarized radiation fields are presented.
Author

N74-31684 Royal Radar Establishment, Malvern (England).
PROBLEMS OF LONG LINEAR ARRAYS IN HELICOPTER BLADES
R. H. J. Cary *In* AGARD Antennas for Avionics Jun. 1974 18 p refs (For availability see N74-31667 21-09)

Helicopter blades offer sites for the inclusion of long microwave antennas to give narrow azimuthal beams scanned by the rotation of the blades. The variation of blade attitude as it rotates is such that it may lag, lead, bend in vertical and horizontal planes and twist, and in consequence places limits on the practical length of a linear array. The choice of location for antennas, either in the front or trailing edge, or out or inboard is discussed. Certain advantages accrue from a design where the antenna is located near the center of gravity of the blade section, and radiating rearwards through the trailing edge, which requires to be of dielectric material. The length of the section of the trailing edge can be employed as a dielectric tapered slab antenna to shape the beam in the vertical plane and give more gain and direct the beam in a given direction. Theoretical discussion of the mechanism of this antenna and the choice of permittivity for the dielectric slab is discussed.
Author

N74-31685 Societe Technique d'Application et de Recherche Electronique, Massy (France).
A COMMUTATION ON ANTENNA SYSTEMS COVERING STANDARD AIRCRAFT AND BALLOONS [SYSTEME D'ANTENNES A COMMUTATION REALISANT UNE COUVERTURE AVION AUX NORMES AEROSAT]
C. Ancona and P. Froidure *In* AGARD Antennas for Avionics Jun. 1974 8 p refs In FRENCH (For availability see N74-31667 21-09)

Aeronautical satellite design, utilizing aircraft antenna systems, to assure hemispheric coverage with a minimum of gain was discussed. Three types of systems were considered: the electric scanner network, mechanical orientation solutions, and commutable antenna systems. Several theoretical aspects of the problem including angular relations, gain of antenna axis assuring such coverage, and the minimum gain in the angular zone considered, were examined.
Transl. by E.H.W.

N74-31686 National Aerospace Lab., Amsterdam (Netherlands).
A LINEAR ARRAY OF BLADE ANTENNAS AS AN AIRCRAFT

ANTENNA FOR SATELLITE COMMUNICATION

O. B. M. Pietersen, J. P. B. Vreeburg, and F. Klinker *In* AGARD Antennas for Avionics Jun. 1974 13 p refs (For availability see N74-31667 21-09)

In a ground-satellite-aircraft communication system the aircraft antenna is a critical part since it has to meet the typical environmental requirements and possess a rather high gain. This paper describes a suitable antenna system, installed on a Fokker Friendship aircraft. It consists of a linear array of blade antennas, a power division and phase shifting network in coax technique and a manual controlled beam selector/indicator. The design of the array is based on a mathematical model that has been constructed from theoretical considerations and experimental results. Mutual coupling effects are accounted for by using scattering coefficients. With the aid of a computer the spacings between the antennas were determined in such a way that a nearly constant directivity in the yaw plane of the aircraft could be expected. The performance of the array was evaluated in several flights in which radiation patterns were measured in the receive and the transmit mode. From these measurements it is concluded that with the linear phased array of eight blade antennas a gain of 10 db can be achieved. Author

N74-31687 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.

UHF LINEAR PHASED ARRAYS FOR AERONAUTICAL SATELLITE COMMUNICATIONS

H. L. Werstiuk, J. D. Lambert, L. A. Maynard, and J. H. Chinnick *In* AGARD Antennas for Avionics Jun. 1974 14 p refs (For availability see N74-31667 21-09)

An ultrahigh frequency phased array antenna has been developed and test flown on a Canadian Forces C-47 Dakota and a C-130 Hercules. Successful voice communications were achieved with the aircraft terminals via the Lincoln Experimental Satellite LES-6 at 300 MHz. The prototype antenna system consists of nine blade antenna elements mounted along the top of the aircraft fuselage. The antenna is electronically scanned and generates a series of symmetrical conical fan beams. The electronics necessary to control the array scan are relatively simple because of the single dimension of the array and the insensitivity of the patterns to large phase errors at each element. This paper describes the techniques used to construct the phased array, and some of the test results obtained. Two methods developed to provide automatic tracking for the array are also described. Author

N74-31688 Transportation Systems Center, Cambridge, Mass.

A COMPARISON OF TWO L-BAND AIRCRAFT ANTENNAS FOR AERONAUTICAL SATELLITE APPLICATIONS

Robert G. Bland and John M. Clarke *In* AGARD Antennas for Avionics Jun. 1974 24 p refs (For availability see N74-31667 21-09)

A comparison is made of the measured performance characteristics of two circularly polarized flush mounted L-band aircraft antennas for aeronautical satellite applications. In order to facilitate radiation pattern measurements, the previously validated technique of using a scale model aircraft antenna was employed. One of the candidate antennas under comparison is a cavity backed dipole fed slot configuration. Measurements were conducted on a 1/10th scale model of a Convair 880 aircraft. The other antenna is an orthogonal mode crossed-slot configuration. In this case measurements were conducted on a 1/20th scale model of a Boeing 707 aircraft which is almost identical in size to the Convair 880. The basic requirements of this class of antenna are to provide moderate gain of +4 above istropic at L-band over the upper hemispheric region of the aircraft. A diversity combination technique study for the two antennas under comparison considers a switched multiple element system in which various fuselage placement and combination arrangements of elements are evaluated. Author

N74-31689 Selenia S.p.A., Rome (Italy). Antenna Section.

CIRCULARLY POLARIZED L-BAND PLANAR ARRAY FOR AERONAUTICAL SATELLITE USE

Benito Palumbo and Salvatore Cosentino *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)

A circularly polarized L-band planar array for aeronautical satellite use is presented. A simple trade-off is outlined among the several earth coverage antenna types mainly for what concerns the constraints on weight and size. From this trade-off a planar array, consisting of two interlaced arrays of transverse and longitudinal slots, appears the most attractive solution, mainly if wide operating bandwidths are not required. The design criteria for such an antenna are presented and the principal electrical critical areas together with the main technological and mechanical characteristics are discussed. The main results on an experimental work on transverse slots are reported with their implications on the antenna design criteria. Experimental results (radiation patterns, VSWR) on a breadboard and on the L-band model are presented. Author

N74-31690 EMI Electronics Ltd., Feltham (England).

UPPER L-BAND TELEMETRY AERIALS FOR ROCKETS AND MISSILES **c07**

J. Mahoney *In* AGARD Antennas for Avionics Jun. 1974 17 p refs (For availability see N74-31667 21-09)

Future telemetry systems on missiles and rockets are likely to operate at upper L-band frequencies. The advantages to be gained and the problems likely to be encountered at these higher frequencies and the effects of change in the radiation pattern due to increased electrical spacing between individual aerials is given for a wide range of missile diameters. Methods of improving the radiation pattern coverage by altering the phase distribution to individual aerials and/or increasing the number of aerials are described. Effects caused by missile projections, i.e. wings and tailfins and surrounding structures such as launcher tubes and aircraft fuselage upon the radiation pattern are discussed. A comparison between the performance of existing telemetry aerials operating at 450 MHz and various prototype upper L-band aerials is given. Problems relating to the working environmental conditions for a wide range of missile applications are described. Author

N74-31691 Rome Air Development Center, Griffiss AFB, N.Y.

ELECTRONICALLY SCANNED TACAN ANTENNA AS AN ENROUTE AND TERMINAL NAVIGATIONAL AID

Edward J. Christopher *In* AGARD Antennas for Avionics Jun. 1974 11 p refs (For availability see N74-31667 21-09)

The principles of operation of present mechanically rotated Tacan antenna systems and their performance characteristics are considered. A Tacan capable of providing full band operation and elelctronic scanning in a single radiating structure is demonstrated. The array approach permits elevation pattern shaping. Through a combination of steep pattern slope at the horizon and low side lobes below the horizon, siting is less sensitive, i.e. bearing errors over the required spacial coverage of the Tacan system, which are introduced by the antenna environment, are minimized. There are no moving parts that require preventive maintenance and modular design allow most repairs to be made in the field, reducing both mean time and mean cost to repair when compared with existing mechanical systems. Author

N74-31692 AEG-Telefunken, Ulm (West Germany).

ANALYSIS OF FINITE ARRAYS OF RECTANGULAR APERTURES ON CONDUCTING ELECTRIC COATED CYLINDERS **c07**

J. Vogt *In* AGARD Antennas for Avionics Jun. 1974 7 p refs (For availability see N74-31667 21-09)

The aim of the presented theory is to investigate the influence of mutal coupling and creeping waves on the performance of a phased array antenna, consisting of a finite number of apertures flush-mounted on the surface of an infinite conducting cylinder with a concentric dielectric covering. The numerical results show that mutual effects are reduced due to the cylinderical structure of the surface, but are increased due to the dielectric covering. Author

N74-31693 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MICROWAVE ANTENNAS FOR HYPERSONIC MISSILES

Christian Pouit *In* AGARD Antennas for Avionics Jun. 1974 4 p refs In FRENCH; ENGLISH summary (For availability see N74-31667 21-09)

Within a flight program aimed at analyzing physical phe-

nomena during reentry of an hypersonic missile into the atmosphere, three types of antennas were used, radiating in the S, C and X frequency bands. The type of antenna chosen (rectangular iris embedded in alumina) allowed a design satisfying particularly severe environment conditiions while retaining a widely open radiation pattern, which permitted an omnidirectional pattern set, to be obtained, by a combination of sets. Author

N74-31694 Royal Aircraft Establishment, Farnborough (England).
THE DESIGN OF WIDE BAND NOTCH AERIALS AND SOME APPLICATIONS TO AVIONICS
George Bagley *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

Experimental results obtained from notches of a variety of rectangular shapes cut in semi-infinite metal sections are reported, and the various conbinations of center frequency and impedance bandwidth which can be obtained from a notch of fixed physical length are illustrated. The results relate to notch used in the self resonant mode, without any additional lumped reactance. The variables investigated (for a fixed length notch) are notch width, thickness of the section, and feed point position. It is possible to drive the notch either as a narrow band quarter wave radiator, or as a half wave radiator with a frequency bandwidth of 2.0:1. Several possible applications are discussed, including an omni-azimuthal horizontally polarized radiator with a band width of 3.0:1. Author

N74-31695* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL FREQUENCY DICHROIC FEED PERFORMANCE **c07**
D. A. Bathker *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)
(Contract NAS7-100)
CSCL 17B

The NASA Deep Space Net (DSN) in support of the Viking Mars Project in 1976, and for science and technology demonstrations during the Mariner-Venus-Mercury mission in 1974, has developed and implemented a dual (S- and X-band) feed for large ground microwave antennas. This feed provides for a multiplicity of functions; very low listening capability at each downlink (spacecraft-to-earth) band as well as simultaneous diplexed very high cw power uplink (earth-to-spacecraft) at the S-band frequency. Total 64-m antenna system performance, is considered in terms of gain, operating noise temperature and dual beam pointing or boresight coincidence. Because of the unique ability to fold or stow the dual band feed elements for single band operations, the performance definition between single and dual band operations will be reliable and accurate. Author

N74-31696 Siemens A.G., Munich (West Germany). Zentrallab. fuer Nachrichtentechnik.
EMPLOYMENT OF NEARFIELD CASSEGRAIN ANTENNAS WITH HIGH EFFICIENCY AND LOW SIDELOBES, TAKING THE INTELSAT-GROUND STATIONS AND THE GERMAN HELIOS-TELECOMMAND STATION AS EXAMPLES **c07**
Uwe Leupelt and Wolfgang Rebhan *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)

A number of the large reflector antennas now employed by ground stations for satellite communication are constructed according to the nearfield Cassegrain technique. After a short description of the basic electrical principles involved as well as of the method of obtaining constant aperture illumination with the nearfield antenna also and thus optimizing efficiency by suitable shaping of the reflectors, a novel design for antennas of this type discussed. It allows the sidelobes of the radiation pattern to be reduced without excessively reducing gain. A special toroidal aperture illumination and a favorable arrangement of the subreflector supports are used for this purpose. The dimensions and design of the 28.5-m antennas already mentioned in connection with the Intelsat system are discussed and the 30-m antenna now under construction for the German Helios telecommand satation described as an example for the realization of an antenna with low sidelobes. The radiation characteristics at higher frequencies and the cross-polarization properties with the aid of measured radiation patterns are illustrated. Author

N74-31697 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Dynamics Div.
DEVELOPMENT OF AN S-BAND DUAL MODE HORN FOR TELEMETRY RECEPTION BY THE 100 M EFFELSBERG RADIO TELESCOPE
W. Hess and B. Liesenkoetter *In* AGARD Antennas for Avionics Jun. 1974 8 p refs (For availability see N74-31667 21-09)

A Gregorian antenna system with 100 m paraboloid is being equipped with a dual mode horn feed in the secondary focus to provide favorable gain and noise temperature characteristics. The limited size of the apex cabine demanded length reduction by optimizing the horn feed zone. In addition a directional coupler, integrated in the horn feed zone, is developed for special test purposes. All measurements during the development period as well as the qualification tests are been carried out on a X-band scaled model. The design of the original horn feed aimed in particular at cheapness, a short manufacturing period and a low weight. Thus a frame construction with non supporting inner horn structure is applied. Author

N74-31698 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Microwave Physics Lab.
ARRAY AND REFLECTOR TECHNIQUES FOR AIRPORT PRECISION APPROACH RADARS
Robert J. Mailloux and Philipp Blacksmith *In* AGARD Antennas for Avionics Jun. 1974 14 p refs (For availability see N74-31667 21-09)

The current state-of-the-art among array and array/reflector antennas for limited scan coverage, is surveyed and some new array techniques for this application are introduced. Other system parameters, such as frequency selection, are discussed in light of their influence on antenna design requirements but the principle task addressed by the paper is to use the parameters of present PAR antenna systems to estimate the potential advantages of new technology. Examples cited as new technology include the use of arrays to feed dual reflectors or lenses for improved aperture efficiency and reduced array size, and the AFCRL array techniques using large multimode apertures for grating lobe suppression and pattern control. Comparisons of these types of technology are given for selected applications. Author

N74-31699 Royal Aircraft Establishment, Farnborough (England).
NOTES ON THE RADIATION PATTERNS OF HF AERIALS INSTALLED ON HELICOPTERS **c07**
W. T. Blackband *In* AGARD Antennas for Avionics Jun. 1974 6 p (For availability see N74-31667 21-09)

The fundamental modes of electrical oscillation of a helicopter are considered and their radiation patterns predicted. Scale model experiments have confirmed these predictions. Two modes of rotor modulation are possible. These have different characteristics, the first affecting signals at all azimuths while the effects of the other are most apparent near to minima in the radiation pattern. Author

N74-31700 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
RADIATION CHARACTERISTICS OF THINNED ARRAY ANTENNAS **c07**
W. Soentgerath *In* AGARD Antennas for Avionics Jun. 1974 10 p refs (For availability see N74-31667 21-09)

The well known statistical relations between element distribution and radiation pattern of density tapered arrays are surveyed. Following a discussion of the statistical distribution of the signal energy in sidelobe directions, the effects on the radiation pattern of a special element distribution, i.e. the minimum distance of half a wavelength between adjacent elements is increased to one wavelength, are also treated. A brief study concerning the problems which are caused by the digitally controlled phase shifters commonly used in phased array technique is included. Author

N74-31701 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
IN-FLIGHT MEASUREMENT OF AIRCRAFT ANTENNAE RADIATION PATTERNS **c07**
Helmut Bothe *In* AGARD Antennas for Avionics Jun. 1974 9 p refs (For availability see N74-31667 21-09)

An in-flight measuring system which is completely independent from groundbased position finding equipment like radar and kinetheodolites. The measuring method is based on VOR (Very High Frequency Omnidirectional Range System) and DME (Distance Measuring Equipment) information obtained onboard the aircraft. This information is telemetered together with the other necessary parameters like heading, altitude, pitch and roll angles. These parameters are used to calculate the aspect angle and the distance of the aircraft from the ground based field intensity measuring device. Real time calculation is done on a digital computer. The computer output supplies aspect angle and distance corrected field intensity as well as flight-path parameters in analog voltages for graphic presentation. After a detailed description of the measuring method and system some examples of measured patterns are shown. In addition the magnitude of possible errors in the plotted radiation patterns are discussed. Author

N74-31702 Naval Research Lab., Washington, D.C.
DYNAMIC MEASUREMENT OF AVIONIC ANTENNAS c07
I. D. Olin and E. E. Maine, Jr. *In* AGARD Antennas for Avionics Jun. 1971 14 p refs (For availability see N74-31667 21-09)

The equipment, data handling, flight control and some of the results obtained with a system specifically designed for dynamic measurements is described. The determination of aircraft aspect angle uses an approach based on measurements made at the ground radar site with the aircraft flying straight line courses. Then making certain assumptions regarding flight attitude, a proper coordinate transformation can be effected and principal plane measurements plotted. The antenna signal source is provided by a delayed beacon triggered by an illuminating radar and driving the antenna under tests. To illustrate the results patterns for a X-band installation are shown. Coverage can be provided for an azimuth profile from nose-on (0 deg) to tail-on (180 deg) and for an elevation profile beam 0 deg to 30 deg below the aircraft for fixed azimuth aspects of nose-on and tail-on. Angle accuracy is + or - 2 degrees and the accuracy of antenna gain measurements is estimated to be + or - db. Author

N74-31703 Technische Hochschule, Aachen (West Germany).
AN IMPROVED MEASURING TECHNIQUE FOR INVESTIGATIONS OF THE NEAR FIELD REGION OF ANTENNAS c07
Ruediger Anders *In* AGARD Antennas for Avionics Jun. 1974 8 p refs (For availability see N74-31667 21-09)

A new scattering technique for low reaction measurements of electromagnetic fields is presented using a small diode probe without any conductive feeder. The basic principle of this technique makes use of the frequency mixing property of a microwave diode as scatterer to convert the probe signal to the X-band microwave range where it easily can be transmitted and picked up by a remote auxiliary antenna. The theoretical background is given and several measurement set-ups for different operation conditions are discussed. Author

N74-31704 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
DETERMINATION OF THE MOVEMENT OF THE APPARENT PHASE CENTERS OF AIRCRAFT ANTENNAS FOR CALIBRATING THE ZDBS INTERFEROMETER c07
A. Ischrott and S. Modabber *In* AGARD Antennas for Avionics Jun. 1974 26 p refs (For availability see N74-31667 21-09)

A new method for the determination of the curve on which the apparent phase centers for an aircraft antenna moving with respect to aspect angles is presented. The definition of the apparent phase center is discussed. The test equipment is explained by means of a schematic diagram. Sources of error and the accuracy of the approximation method for analytical determination of the phase function are also discussed. An ALGOL computer program is developed for the calculation of apparent phase centers from measured data. Finally, the development and the optimization of the radiators meeting the requirements are described. Author

N74-31705 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
OFF-BORESIGHT ANGLE ESTIMATION WITH A PHASE COMPARISON MONOPULSE SYSTEM c07
W. Sander *In* AGARD Antennas for Avionics Jun. 1974 13 p refs (For availability see N74-31667 21-09)

The problem of estimating the angle of arrival is considered for phase comparison monopulse (PCM) system in the presence of internally generated thermal noise. A maximum likelihood analysis produces the form of the estimate which does not differ essentially from that found earlier for an amplitude comparison monopulse (ACM) system. In deriving the probability density function of the estimate, no approximations of the nonlinear monopulse error curve are made. Therefore mean and variance of the estimate computed by numerical integration are valid at any signal noise-ratio and at any angle. The bias of the estimate at low and moderate SNR is higher than known by other theories. A computer simulation proves the correctness of the results. A comparison between radar and passive beacon tracking mode is made, and the problem of bidimensional angle measurement is mentioned. Author

N74-31706* Ohio State Univ., Columbus. ElectroScience Lab.
ROLL PLANE ANALYSIS OF ON-AIRCRAFT ANTENNAS c07
W. D. Burnside, R. J. Marhefka, and C. L. Yu *In* AGARD Antennas for Avionics Jun. 1974 23 p refs (For availability see N74-31667 21-09)
(Grant NGR-36-008-144)
CSCL 17B

The roll plane radiation patterns of on-aircraft antennas are analyzed using high frequency solutions. This is a basic study of aircraft-antenna pattern performance in which the aircraft is modelled in its most basic form. The fuselage is assumed to be a perfectly conducting elliptic cylinder with the antennas mounted near the top or bottom. The wings are simulated by arbitrarily many sided flat plates and the engines by circular cylinders. The patterns in each case verified by measured results taken on simple models as well as scale models of actual aircraft. Author

N74-31707 Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
INVESTIGATION OF CHARACTERISTICS AND PRACTICAL IMPLEMENTATION OF ARBITRARILY POLARIZED RADIATORS IN SLOT ARRAYS
J. S. Ajioka, D. M. Joe, R. Tang, and N. S. Wong *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)
(Contract F19628-70-C-0142)

The feasibility of obtaining arbitrary polarization in both one and two dimensional arrays of slots in dual mode bifurcated waveguides has been demonstrated. The radiating element consists of a pair of crossed slots in the sidewall of a bifurcated rectangular waveguide that couple to even and odd waveguide modes. One linear polarization is excited by the even or sum mode and the orthogonal linear polarization is excited by the odd or difference mode. By superposing the sum and difference modes in the proper amplitude and phase, any arbitrary polarization can be synthesized. A two-dimensional array consisting of eight waveguide linear arrays, ferrite phase shifters for scanning in the plane normal to the linear arrays and a feed network for power distribution and polarization control was constructed. Good radiation performance for various polarizations was obtained. In the case of linear polarization, the cross polarization component was down on the order of minus 25 db and in the case of circular polarization, the axial ratio was on the order of 1 db. The polarization was controlled with a phase shifter. Close in sidelobes of better than 20 db were obtained for all polarizations. Author

N74-31708 Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
STEPPED REFLECTOR ANTENNA WITH A SECTOR SHAPED MAIN BEAM
H. Thielen *In* AGARD Antennas for Avionics Jun. 1974 15 p refs (For availability see N74-31667 21-09)

The optimum pattern of an antenna of telecommunication or television broadcasting satellites consists in a sector shaped main beam without any side lobes. In this case the edge gain is 4.1 db higher than that of a conventional antenna. Theory

indicates that such a pattern is produced by a circular aperture illuminated by the oscillating function. Measurements were made with a paraboloid reflector antenna containing a dielectric dish in its central zone. This dish effects a phase reversal of 180 deg between the central zone and the remaining ring zone of the reflector. the edge gain of this antenna is 1 db higher than that of a conventional antenna. An increase of 1.4 db obtained by a better feed system. It is also possible to achieve the phase reversal by an arrangement of metallic steps with a height of about one quarter wavelength. If an antenna with two or more ring zones is used, a further increase of the edge gain can be obtained. Author

N74-31709*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARAMETRIC ANALYSIS OF AN IMAGING RADAR FOR USE AS AN INDEPENDENT LANDING MONITOR

W. Thomas Bundick Washington Aug. 1974 73 p refs
(NASA-TN-D-7652; L-9322) Avail: NTIS HC $3.75 CSCL 17I

The capabilities are analyzed of a real aperture, forward-looking imaging radar for use as an independent landing monitor, which will provide the pilot with an independent means of assessing the progress of an automatic landing during Category 3 operations. The analysis shows that adequate ground resolution and signal-to-noise ratio can be obtained to image a runway with grassy surroundings using a radar operating at 35 GHz in good weather and in most fog but that performance is severely degraded in moderate to heavy rain and wet snow. Weather effects on a 10 GHz imager are not serious, with the possible exception of very heavy rain, but the azimuthal resolution at 10 GHz is inadequate with antennas up to 2 m long. Author

N74-31710*# Washington Univ., St. Louis, Mo. Communications Group.
PROGRAM ON APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT: DESIGN OF A 12 CHANNEL FM MICROWAVE RECEIVER
Craig O. Risch, Fred J. Rosenbaum, and Robert O. Gregory Jul. 1974 166 p refs
(Grant NGR-26-008-054)
(NASA-CR-139640; R(T)-74/2) Avail: NTIS HC $11.50 CSCL 17B

The design, fabrication, and performance of elements of a low cost FM microwave satellite ground station receiver is described. It is capable of accepting 12 contiguous color television equivalent bandwidth channels in the 11.72 to 12.2 GHz band. Each channel is 40 MHz wide and incorporates a 4 MHz guard band. The modulation format is wideband FM and the channels are frequency division multiplexed. Twelve independent CATV compatible baseband outputs are provided. The overall system specifications are first discussed, then consideration is given to the receiver subsystems and the signal branching network. Author

N74-31711# National Bureau of Standards, Boulder, Colo. Electromagnetic Metrology Information Center.
THE MEASUREMENT OF LUMPED PARAMETER IMPEDANCE: A METROLOGY GUIDE Final Report
Raymond Nelson Jones and W. J. Anson, ed. Jun. 1974 211 p refs
(NBS Proj. 2729103)
(NBS-Mono-141; LC-74-8060) Avail: SOD HC $5.50 as C13.44:141

The measurement of two-terminal impedance in the 30 kHz to 300 MHz range involves a variety of different methods including null, resonance, active and comparison. Each method is represented by a number of instruments having specific capabilities, strengths, and weaknesses. This metrology guide is intended to assist the scientist who is not intimately familiar with impedance measurement, in the selection and use of the best instrument for a particular requirement. Information is included on range and accuracy capabilities as well as availability and ease of operation. An extensive bibliography is included to assist in pursuing a particular problem beyond the depth of the guide. Author

N74-31712*# Scientific Translation Service, Santa Barbara, Calif.
MICROSTRIP DISC RESONATORS
Ingo Wolff and Norbert Knoppik Washington NASA Aug. 1974 29 p refs Transl. into ENGLISH from Arch. Elektronik Uebertragungstech., v. 28, no. 3, 1974 p 101-108
(Contract NASw-2483)
(NASA-TT-F-15889) Avail: NTIS HC $4.50 CSCL 09E

A method is presented to calculate the resonance frequencies of rectangular and circular microstrip disc resonators. The influence of the electromagnetic field distribution under the discs, and the influence of the fringing field at the edge of the discs on the resonance frequencies is taken into account by defining an effective width or radius and a dynamic dielectric constant. Author

N74-31713# Defence Standards Labs., Maribyrnong (Australia).
THE ELECTRICAL CHARGING OF UNIFORM LATEX - SPHERES PRODUCED BY SPRAYING AND DRYING
G. H. Thomson Jun. 1974 15 p refs
(DSL-TN-295) Avail: NTIS HC $4.00

The distribution of the electrical charges on uniform latex spheres was measured immediately after generation by spraying and drying, using a parallel plate condenser and a Royco PC-200 particle counter. The aerosols were found to have a zero net charge. The average number of charges was 4.8 on the 0.5 micron particles and 5.6 on the 1 micron particles. Author

N74-31714# Telefonaktiebolaget L. M. Ericsson, Stockholm (Sweden). MI Div.
FEASIBILITY STUDY OF A CAVITY STABILIZED 13 GHz OSCILLLATOR Final Report
T. Hedstroem Dec. 1973 39 p
(MI/Km-3261; ESRO-CR(P)-409) Avail: NTIS HC $5.00

The oscillator design features an impatt diode, mounted with a high Q cavity in a waveguide structure. Because of the stability requirements, the oscillator is housed in an evacuated envelope and temperature regulated by means of an oven. A breadboard model of the oscillator was designed and evaluated against the proposed specification. It was shown that the oscillator design meets or exceeds the proposed specification for output power, noise, frequency stability, spurious signals, pushing, pulling, and weight. The dc power consumption is higher than specified but can be reduced if the output coupling is increased or a high efficiency diode is used. Some measurement problems were encountered due to leakage of the vacuum envelope and changes in the thermal resistance to the heat sink because of mechanical failures. Author (ESRO)

N74-31715# Cambridge Consultants Ltd. (England).
THE STATUS, DEVELOPMENT AND APPLICATIONS IN SPACE OF SOLID-STATE IMAGING SYSTEMS Final Report
D. A. Curtis, R. J. Granger, and M. H. Ross Apr. 1974 215 p refs
(Contract ESTEC-1972/73-BS)
(ESRO-CR(P)-416) Avail: NTIS HC $12.75

The development of all-solid-state imaging technologies since 1969 is reviewed. The bucket-brigade device and its predecessors, the self-scanned array and matrix array, were superceded by the charge coupled device (CCD) and the charge injection device (CID). It is shown how the CCD technology has rapidly evolved to the stage where commercial devices are offered with two buried channel CCD arrays, one with 500 x 1 elements, and the other with 100 x 100 elements. Problems associated with available basic dimensions of materials and photomasks are described. The operational problems are principally electronic, and pertain to ensuring good signal to noise ratios and high frequency operation. Recommendations are given to concentrate on buried-channel CCDs as offering the most chance of satisfying applications in space. ESRO

N74-31716# Rensselaer Polytechnic Inst., Troy, N.Y. Mechanics Div.
AN ANALYSIS OF INTERMODULATION IN THICK-SHEAR AND TRAPPED ENERGY RESONATORS
H. F. Tiersten May 1974 53 p refs
(Contract N00014-67-A-0117-0007; NR Proj. 017-504)
(AD-780445; TR-11) Avail: NTIS CSCL 09/1

Electroelastic equations containing terms up to cubic in the

small mechanical displacement field, but no higher than linear in the electric variables, are applied in the analysis of intermodulation in rotated Y-cut quartz oscillators. Both pure thickness-shear trapped energy resonators are treated. Lumped parameter representations of the solutions, which are valid in the vicinity of a resonance, are presented for the linear and nonlinear portions of both the pure thickness-shear and trapped energy thickness-shear problems. The influence of the driving and detecting circuitry is included and, in particular, in each case the relation between the intermodulation and driving voltage is obtained. (Modified author abstract) GRA

N74-31717# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTRON BEAM INDUCED DEGRADATION IN EBS DIODES
William E. Krag 20 May 1974 56 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-780521; TN-1974-33; ESD-TR-74-210) Avail: NTIS CSCL 09/1

The report describes the effects of ionizing radiation on oxide-semiconductor structures and, in particular, the effects of electron beams on the characteristics of EBS devices. Several methods of protecting the EBS diodes from the effects of the high energy electron beam are proposed and discussed. Brief mention is made of some experiments which have been performed. Author (GRA)

N74-31718# Lehigh Univ., Bethlehem, Pa.
RADIATION EFFECTS OF MOS GATE INSULATORS Final Report, Jul. - Dec. 1973
Frederick M. Fowkes, Walter E. Kahlke, and Sidney R. Butler Jan. 1974 45 p refs
(Contract DAAG39-73-C-0200; HDL Proj. 23532B; DNA Proj. NWET-Z99QAXT)
(AD-780186; HDL-TR-200-1) Avail: NTIS CSCL 09/1

Impurity metal ions (sodium, aluminum, chromium, and gold) were diffused (and grown) into oxide films on silicon which were then exposed to 1,000,000 rads of ionizing radiation from a cobalt-60 source. The effects of radiation were observed by chemical analysis (to determine ion transport) and by conductance and capacitance measurements (to determine oxide charge and distribution of surface state density). (Modified author abstract) GRA

N74-31719# Signatron, Inc., Lexington, Mass.
ELECTRON DEVICE MODELING Interim Technical Report, 13 Aug. - 13 Nov. 1973
L. Ehrman Mar. 1974 171 p
(Contract F30602-73-C-0193)
(AD-780032; RADC-TR-74-68; ITR-3) Avail: NTIS CSCL 09/1

A new technique for computing the nonlinear transfer functions of an interacting cascade of nonlinear networks is discussed, and an example of its use given. Experimentally determined nonlinear parameters of a MOSFET tetrode are given, and an equivalent circuit is shown for the device. The programming of some of the software for deriving the parameters of a charge-control bipolar transistor is presented. Author (GRA)

N74-31720# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
COUPLED TRANSMISSION LINES. PART 1: THEORY Final Report
Clayton R. Paul Mar. 1974 215 p refs
(Contract F30602-72-C-0418; AF Proj. 4540)
(AD-780038; RADC-TR-74-61-Pt-1) Avail: NTIS CSCL 09/1

The unintentional coupling of energy between wires in cable bundles which connect electronic subsystems is an important source of interference on aircraft, missiles, and ground systems. In the prediction of intrasystem electromagnetic compatibility in recent years, more reliance is being placed on computed codes and within these codes, models are required for predicting the wire coupled interference. It is the purpose of this report to investigate the prediction of wire-to-wire coupling. Part I introduces the general theories of formulation of equations, solution of the equations and assumptions inherent in these formulations which are common to all transmission line analyses regardless of their areas of application. GRA

N74-31721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROSPECTS FOR THE APPLICATION OF FERRITES (MAGNITODIELECTRICS) IN ELECTRICAL MACHINES
A. I. Adamenko, B. A. Troitskii, and A. I. Yakovlev 18 Apr. 1974 8 p Transl. into ENGLISH from Elektrontekhnika (USSR), no. 4, Apr. 1973 p 61-62
(FTD Proj. T74-04-03)
(AD-779812; FTD-HT-23-1187-74) Avail: NTIS CSCL 09/1

Describes progress in the use of ferrites in the U.S.S.R. GRA

N74-31722# Syracuse Univ., N.Y.
A SCATTERING VARIABLE APPROACH TO NONLINEAR SYSTEMS Technical Report, 1 Jul. 1972 - 1 Jul. 1973
Gerald Naditch May 1974 215 p refs
(Contract F30602-72-C-0360)
(AD-780535; RADC-TR-74-106) Avail: NTIS CSCL 09/5

A new mathematical model is developed which extends Volterra series analysis of nonlinear systems with memory to high-frequency systems, including those containing linear, passive, distributed component devices. Scattering variables, described by a linear transformation of voltage and current in lumped circuits, and by incident and reflected waves in distributed circuits, are used as fundamental quantities in Volterra functional series. A set of nonlinear Volterra scattering kernels results describing the output signal behavior of the system. The frequency-domain Volterra kernels, which can be interpreted as generalized response functions, are analogous to linear scattering parameters. They can be used to describe power transfer and distortion measures of nonlinear multi-ports. In particular, when the input signal amplitudes are small, the nth order harmonic component in the output signal can be closely approximated by evaluating a single kernel. (Modified author abstract) GRA

N74-31723# Hughes Research Labs., Malibu, Calif.
CROSSED-FIELD CLOSING-SWITCH DEVELOPMENT Final Report, 10 May - 9 Nov. 1973
M. A. Lutz and H. Alting-Mees Apr. 1974 94 p refs
(Contract F29601-73-C-0103; AF Proj. 317J)
(AD-780595; AFWL-TR-73-294) Avail: NTIS CSCL 09/1

The basic objective of the program was to determine the feasibility of using a novel type of spark-gap switch called a cross-field closing switch for applications at the 60-kV, 20-kA, 20-microsec level. This entailed single-shot testing at these levels to determine the following critical items: (1) anode fall time, (2) ignition jitter, (3) voltage recovery rate, (4) gas cleanup rate, (5) arc uniformity, and (6) triggering and control levels. A second objective of this program was to design a cross-field closing switch to operate at the above levels, but at a repetition rate of 250 Hz, that gave an average switch current of 100 A. The experimental program proved the feasibility of the tube on a single-shot basis. (Modified author abstract) GRA

N74-31724# IIT Research Inst., Chicago, Ill. Reliability Analysis Center.
MICROCIRCUIT DEVICE MALFUNCTION REPORT
Irvin L. Krulac Feb. 1974 168 p Revised
(Contract F30602-73-C-0065)
(AD-779310; RAC-MDMR-0274-Rev) Copyright. Avail: NTIS HC $42.50; MF $42.50 CSCL 09/5

The document provides a complete history of malfunctions reported during equipment assembly, test checkout and field operations. Where performed, failure autopsy results and corrective actions are also indicated. The listing is organized and presented by manufacturer and part type. Entries also identify other pertinent device descriptors such as applied screens, package type, manufacturing date code as well as the system designation on the date malfunction was reported. The report is completely revised and reissued semiannually. (Modified author abstract) GRA

N74-31725# Army Foreign Science and Technology Center, Charlottesville, Va.
INFLUENCE OF BUILT-IN FIELD HETEROGENEITY ON SEMICONDUCTOR PICKUP EFFICIENCY
V. M. Evdokimov and A. F. Milovanov 20 Mar. 1974 20 p refs Transl. into ENGLISH from Geliotekh. (USSR), no. 4, 1972

p 24-35
(AD-781155; FSTC-HT-23-1851-73) Avail: NTIS CSCL 09/1

The optimal curvature of the potential of the built-in field of a planar photocell with p-type doped layer n-type base and its effect on the efficiency of doped layer pickup are examined. The photocell is illuminated on the doped layer side. The pickup efficiency maximum was found to depend on the surface recombination rate. In some field configurations the photocell is less sensitive to the rate of surface recombination. The gain in pickup of carriers generated with shortwave radiation, for a particular field configuration, is approximately 50%.

Author (GRA)

N74-31726# Watkins-Johnson Co., Palo Alto, Calif.
EBS (ELECTRON BEAM SEMICONDUCTOR) PULSE AMPLIFIER LIFE TEST Final Engineering Report, 13 Feb. 1973 - 28 Jan. 1974
28 Jan. 1974 18 p
(Contract N00039-73-C-0052)
(AD-779908) Avail: NTIS CSCL 09/5

Highly stable, high voltage, beam shield passivated diodes were fabricated for use in EBS (electron beam semiconductor) grid controlled pulse amplifiers. Six EBS pulse amplifiers were fabricated using these diodes and four of the EBS amplifiers were operated on life test for a total socket time of 14,500 hours. Data is presented showing that stable diode operation was obtained. Author (GRA)

N74-31727# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
HIGH ENERGY HIGH DUTY PULSER Final Report, Feb. 1973 - Feb. 1974
Mar. 1974 272 p
(Contract F30602-73-C-0151)
(AD-780031; RADC-TR-74-77) Avail: NTIS CSCL 09/5

The report presents the results of a one year in-depth study on achieving a high peak energy and high average power pulser. Design objectives are for a 2.5 gigawatt peak power/10 megawatt average power pulser supplying 20 microsecond pulses at 200 pulses per second. An artificial line type modulator with hydrogen thyratron switch tubes was chosen for the pulser design. Emphasis was placed on selection of the type of switching device (hydrogen thyratrons versus spark gaps versus solid state versus mercury pool switches, etc.), and on selection of a particular device of the chosen type. Hydrogen thyratrons were chosen over competing types of switches because suitable types are available off the shelf, whereas all of the competing types require some development work to meet the requirements. A sample pulser design, using the KU-275 hydrogen thyratron, is given.

Author (GRA)

N74-31728# Florida Univ., Gainesville. Dept. of Electrical Engineering.
SOLID STATE MATERIALS AND DEVICES Final Report, 1 Sep. 1972 - 31 Aug. 1973
Fredrik A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, and Sheng S. Li 1 Dec. 1973 142 p refs
(Contract F19628-72-C-0368; AF Proj. 1060)
(AD-781165; AFCRL-TR-74-0044) Avail: NTIS CSCL 09/1

Contents: Transistor circuit models; Questionability of drift-diffusion transport in the analysis of small semiconductor devices; The effect of neutron radiation on noise in field-effect transistors; A new high sensitivity integrated silicon Schottky-barrier phototransistor; Analyses of transient capacitance experiments for Au-GaAs Schottky barrier diodes in the presence of deep impurities and the interfacial layer; An evaluation of carrier domain devices for functional integrated circuits. GRA

N74-31729# Raytheon Co., Waltham, Mass.
MILLIMETER WAVE AVALANCHE TRANSIT TIME DIODE AMPLIFIER Quarterly Report, 1 Jul. - 31 Dec. 1972
Wen C. Chen and Leslie H. Sims May 1974 40 p refs
(Contract DAAB07-72-C-0228)
(AD-780702; SM-342; ECOM-0228-1-72; QR-1-2) Avail: NTIS CSCL 09/5

Preliminary flip-chip diodes were fabricated, and several wafers of GaAs epitaxial material were chosen for further diode development work. In addition to the diode effort, initial plans were made on the design of the avalanche diode amplifier. The approach chosen was a 3 stage ADA which assumed that the required circulator design and fabrication would be done in house in order to meet the overall amplifier requirements. During the second quarter, all of the effort was concentrated on the evaluation of GaAs epi material for its IMPATT diode potential. 50% of the initial 28 crystal wafers were found to be suitable for millimeter wave avalanche transit time diode fabrication. In order to reduce the parasitics and to increase the power handling capability of the diode the major portion of the effort concentrated on the fabrication of plated heat sink (PHS) type millimeter wave IMPATT diodes. Nine wafers were recommended for PHS diode fabrication. (Modified author abstract) GRA

N74-31730# Raytheon Co., Waltham, Mass.
MILLIMETER WAVE AVALANCHE TRANSIT TIME DIODE AMPLIFIER Quarterly Report, 1 Jan. - 31 Mar. 1973
R. Fekete May 1974 19 p refs
(Contract DAAB07-72-C-0228; DA Proj. 1S7-62705-AH-94)
(AD-780861; SM-385; ECOM-0228-3-72; QR-3) Avail: NTIS CSCL 09/1

During this period, the fabrication of millimeter-wave diodes from selected GaAs wafers continued. The devices were evaluated as oscillators and their maximum output power and oscillation frequency was measured. Design of the millimeter-wave ADA has been started. Preliminary design of the circulators for the ADA has been completed, and the first unit has been built.

Author (GRA)

N74-31731# Texas Univ., Austin. Electronics Research Center.
TEXAS BIANNUAL OF ELECTRONICS RESEARCH NO. 18 Interim Report, 1 Apr. - 30 Sep. 1973
Arwin A. Dougal, J. K. Aggarwal, O. M. Friedrich, Jr., D. G. Lainiotis, and E. J. Powers 15 Nov. 1973 347 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-781139; AFOSR-74-0963TR) Avail: NTIS CSCL 09/3

Research topics in progress, recent findings, and future plans in the areas of biomedical electronics; information systems; plasma and quantum electronics; solid state electronics; and acoustics and radio sciences are presented. This eighteenth biannual is highlighted by new results obtained in several of these areas.

Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-31732# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
IDENTIFICATION OF UNKNOWN DYNAMIC SYSTEM PARAMETERS [IDENTIFIZIERUNG UNBEKANNTER KENNWERTE VON DYNAMISCHEN SYSTEMEN]
Gisela Hase 20 Dec. 1973 49 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(TB-168) Avail: NTIS HC $5.50

Several nonlinear filter methods and their suitability to systems identification were investigated and compared. Here, systems identification is meant to be the simultaneous estimation of system parameters and state magnitudes of a dynamic system. It is shown how the systems identification can be reduced to a simple state estimation, and thereby to a filter problem. ESRO

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-31733# Advisory Group for Aerospace Research and Development, Paris (France).
LARGE WINDTUNNELS: REQUIRED CHARACTERISTICS AND THE PERFORMANCE OF VARIOUS TYPES OF TRANSONIC FACILITY
R. C. Pankhurst, ed. (Min. of Defense, London) Jun. 1974 156 p refs In ENGLISH; partly in FRENCH
(AGARD-R-615) Avail: NTIS HC $11.00

A series of reports were prepared to analyze the requirements and characteristics of transonic wind tunnels. Some of the subjects considered are: (1) the effects of flow turbulence and noise on aerodynamic phenomena in wind tunnels, (2) testing time requirements in steady and unsteady wind tunnel measurements, (3) design principles for transonic wind tunnels, and (4) methods for correcting wall constraints in transonic wind tunnels. For individual titles, see N74-31734 through N74-31741.

N74-31734 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EFFECTS OF FLOW TURBULENCE AND NOISE AND AERODYNAMIC PHENOMENA AND WINDTUNNEL RESULTS **c12**
R. Michel *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 27 p refs In ENGLISH and FRENCH (For availability see N74-31733 21-11)

An account is given of the influence of stream turbulence and noise on transition in laminar boundary layers and on the development of boundary layers that are already turbulent. This is followed by a discussion of the effects of turbulence and noise on wind tunnel measurements of overall force and moment coefficients and on phenomena associated notably with interactions between shockwaves and boundary layers. These considerations are vital to the extrapolation of wind tunnel results to full-scale conditions and to the specification of Reynolds number and flow quality requirements for future aerodynamic testing facilities. Author

N74-31735 Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
NOTES CONCERNING TESTING TIME REQUIREMENTS IN STEADY AND UNSTEADY MEASUREMENTS **c12**
J. W. G. VanNunen *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 19 p (For availability see N74-31733 21-11)

The importance of time factors in conducting transonic wind tunnel tests is discussed. Emphasis is placed on the requirements for force and pressure measurements in steady flow conditions, pressure measurements on oscillating models for flutter calculations, and investigations of aerodynamic buffeting. The specific time requirements for various types of wind tunnel tests are analyzed to show the variations in the tunnel operations. Diagrams of the various wind tunnel model arrangements and data reduction techniques are included. Author

N74-31736 ARO, Inc., Arnold Air Force Station, Tenn. Karman Gas Dynamics Facility.
EXPERIMENTAL STUDIES IN A LUDWIEG TUBE TRANSONIC TUNNEL
C. J. Schueler *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 46 p refs Prepared in cooperation with AEDC (For availability see N74-31733 21-11)

In support of the development of a high Reynolds number transonic tunnel (HIRT), extensive use has been made of a 1/13-scale model of the facility. The studies included measurement and analysis of the boundary layers at the charge tube exit (entrance to nozzle), at the nozzle (contraction) exit, and in the test section, tunnel start time, test section Mach number flow uniformity, flow response time, pressure distributions on a two-dimensional airfoil model, force measurements on cones, an investigation of the influence of plenum volume and an investigation of the acoustics of the exhaust system. The results of the experimental work show the feasibility of obtaining high Reynolds numbers in a transonic tunnel with a Ludwieg tube drive system. Author

N74-31737 Aeronautical Research Inst. of Sweden, Stockholm. Engineering Dept.
APPLICATION OF THE GASOMETER STORAGE CONCEPT TO A TRANSONIC WINDTUNNEL MEETING THE LAWS SPECIFICATION
C. Nelander and B. Oeverby *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 7 p refs (For availability see N74-31733 21-11)

A drive system to improve the flow quality in a transonic test section of an intermittent wind tunnel. The system proposed consists of a piston and a U-tube gasometer for air storage. The construction of the device is illustrated and the method of operation is explained. The advantages and disadvantages of the proposed system are analyzed. Author

N74-31738 Royal Aircraft Establishment, Farnborough (England).
THE DESIGN OF HIGH-REYNOLDS-NUMBER, TRANSONIC WINDTUNNELS: SOME GENERAL PRINCIPLES
P. G. Pugh *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 22 p refs (For availability see N74-31733 21-11)

The general principles governing the design of a high-Reynolds-number transonic wind tunnel are examined. After a brief review of the essential design aims, the choice of size and operating pressure is discussed. With a rationale for these parameters established, means of achieving them are considered: in particular, the relative merits of various types of drive system are discussed. Author

N74-31739 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
ADDENDUM TO A SURVEY OF CORRECTING WALL CONSTRAINTS IN TRANSONIC WINDTUNNELS **c12**
J. C. Vayssaire *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 21 p refs (For availability see N74-31733 21-11)

Methods for correcting wall constraints in transonic wind tunnels are discussed. Using linearized compressible flow theory, the influence of wingspan upon lift interference factors is examined. The streamline curvature correction is also considered, together with the influence of the position of the pressure datum in relation to that of the model. The characteristics of porous walls are considered with the proposal that a porous wall may be calibrated by comparing a test result with theoretical grid results computed for several values of porosity parameter in the boundary conditions. Author

N74-31740 Royal Aircraft Establishment, Farnborough (England).
SOME OBSERVATIONS ON OPTIONS FOR A LARGE TRANSONIC WINDTUNNEL
P. G. Pugh and D. Kuechemann *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 6 p refs (For availability see N74-31733 21-11)

The design parameters for transonic wind tunnel development are discussed. The two types of specifications which influence the design parameters are defined. Specific considerations concern: (1) provision for exceptional tests, (2) the quality of the flow, and (3) heat transfer from the wind tunnel model. The effects of flow instability in the wind tunnel are analyzed. Author

N74-31741 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
REVIEW OF SOME PROBLEMS RELATED TO THE DESIGN AND OPERATION OF LOW SPEED WINDTUNNELS FOR V/STOL TESTING, ADDENDUM
M. Carbonaro *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 3 p refs (For availability see N74-31733 21-11)
(AGARD-R-601)

A method of calculating wall interference in transonic wind tunnels by using a vortex lattice to simulate the wind tunnel walls is discussed. The method includes the effects of wake

curvature and wake displacement due to the wind tunnel walls. The flow distortions produced by a wind tunnel model are examined with respect to the minimum test speed and the maximum model-to-tunnel dimension ratio. Additional test procedures involving ventilated walls, simulated ground effect, and flow disturbances in the tunnel circuit are briefly noted. Author

N74-31742# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

DEVELOPMENT OF A PORTABLE SONIC BOOM SIMULATOR FOR FIELD USE

N. D. Ellis, I. B. Rushwald, and H. S. Ribner Jul. 1974 33 p refs Sponsored by Ministry of Transport

(UTIAS-TN-190) Avail: NTIS HC $4.75

A portable sonic boom simulator has been developed for field tests on wildlife. Previous portable simulators have been mobile only by truck or trailer; the present device weighs 24.4 pounds including peripherals and is easily carried by one person. It consists of a shock tube charged by a compressed air bottle, coupled to an exponential horn. A low-pass acoustic filter is mounted in the horn; it serves to control the rise time of the pressure signature. The simulated sonic booms mimic the loudness of typical sonic booms and have comparable overpressures and rise times. Calibration of the effective loudness is by subjective comparison with idealized standard sonic booms (N-waves). The calibration is carried out in the recently developed UTIAS loudspeaker driven sonic boom booth. The loudspeakers accurately reproduce the signatures to be compared which have been tape recorded, and they are judged against the N-waves for equal loudness by an observer in the booth. The outcome is expressed as equivalent sonic boom overpressure as a function of shock-tube driver pressure and observer position relative to the portable simulator. Author

N74-31743*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.

SKYLAB EXTRAVEHICULAR MOBILITY UNIT THERMAL SIMULATOR Final Report

C. W. Hixon and M. A. Phillips Jul. 1974 111 p refs

(Contract NAS9-12580)

(NASA-CR-134389; T194-06) Avail: NTIS HC $8.75 CSCL 14B

The analytical methods, thermal model, and user's instructions for the Skylab Extravehicular Mobility Unit (SEMU) routine are presented. This digital computer program was developed for detailed thermal performance predictions of the SEMU on the NASA-JSC Univac 1108 computer system. It accounts for conductive, convective, and radiant heat transfer as well as fluid flow and special component characterization. The program provides thermal performance predictions for a 967 node thermal model in one thirty-sixth (1/36) of mission time when operated at a calculating interval of three minutes (mission time). The program has the operational flexibility to: (1) accept card or magnetic tape data input for the thermal model describing the SEMU structure, fluid systems, crewman and component performance, (2) accept card and/or magnetic tape input of internally generated heat and heat influx from the space environment, and (3) output tabular or plotted histories of temperature, flow rates, and other parameters describing system operating modes. Author

N74-31744# National Aeronautical Lab., Bangalore (India). Aerodynamics Div.

ON THE APPLICATION OF RADIAL-SPLITTERS FLOW SPREADERS IN THE NAL 1-FT BLOWDOWN TUNNEL

S. N. Seshadri and D. M. Rao Jun. 1974 18 p ref

(AE-TM-8-74) Avail: NTIS HC $4.00

The use of radial splitters for effective flow spreading in the approach section wide angle diffuser of the NAL 1 ft trisonic wind tunnel is described. Flow surveys in the exit plane of the diffuser prior to the installation of splitters indicated severe flow separation. The introduction of an eight-vane radial splitter assembly, extending over the first 2/3 of the diffuser length resulted in greatly improved exit flow uniformity. Operational benefits obtained after the introduction of splitters were the following: (1) alleviation of aerodynamic loading on antiturbulence screens located downstream of the diffuser, resulting in greatly increased screen life; and (2) a remarkable improvement in the test section flow steadiness as evidenced by smooth output of the strain gauge balance in model force tests, leading to satisfactory digital data acquisition. Author

N74-31745*# Curtiss-Wright Corp., Wood-Ridge, N.J. Power Systems Div.

FINAL ANALYSIS AND DESIGN OF A THERMAL PROTECTION SYSTEM FOR 8-FOOT HTST COMBUSTOR

S. Moskowitz Apr. 1973 88 p refs

(Contract NAS1-11714)

(NASA-CR-132467; CW-WR-74-016) Avail: NTIS HC $4.00 CSCL 14B

The cylindrical shell combustor with T-bar supports in the 8-foot HTST at the NASA-Langley Research Center encountered vibratory fatigue cracking over a period of 50-250 tunnel tests within a limited range of the required operating envelope. A preliminary design study provided several suitable thermal protection system designs for the combustor, one of which was a two-pass regenerative type air-cooled omega-shaped segment liner. A final design layout of the omega segment liner was prepared and analyzed for steady-state and transient conditions. The design of a support system for the fuel spray bar assembly was also included. Detail drawings suitable for fabrication purposes were also prepared. Liner design problems defined during the preliminary study included (1) the ingress of gas into the attachment bulb section of the omega segment, (2) the large thermal gradient along the leg of the omega bulb attachment section and, (3) the local peak metal temperature at the radius between the liner ID and the leg of the bulb attachment. These were resolved during the final design task. Analyses of the final design of the omega segment liner indicated that all design goals were met and the design provided the capability of operating over the required test envelope with a life expectancy substantially above the goal of 1500 cycles. Author

N74-31746*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GSFC VENUS ATMOSPHERE SIMULATOR

M. S. Cridlin and J. A. Munford Feb. 1974 19 p

(NASA-TM-X-70739; X-753-74-229) Avail: NTIS HC $4.00 CSCL 14B

The design and preliminary testing of a Venus Atmosphere Simulation System are described. The system was designed for testing a quadrupole mass spectrometer proposed for the Pioneer-Venus Experiment. The system is capable of providing programmed temperature cycles up to 550 C, and manually controlled pressure up to 100 atmospheres. Author

N74-31747*# Rensselaer Polytechnic Inst., Troy, N.Y.

RECOGNITION OF THREE DIMENSIONAL OBSTACLES BY AN EDGE DETECTION SCHEME

Martin A. Reed May 1974 75 p refs

(Grant NGL-33-018-091)

(NASA-CR-139661; RPI-TR-MP-45) Avail: NTIS HC $6.75 CSCL 13F

The need for an obstacle detection system on the Mars roving vehicle was assumed, and a practical scheme was investigated and simulated. The principal sensing device on this vehicle was taken to be a laser range finder. Both existing and original algorithms, ending with thresholding operations, were used to obtain the outlines of obstacles from the raw data of this laser scan. A theoretical analysis was carried out to show how proper value of threshold may be chosen. Computer simulations considered various mid-range boulders, for which the scheme was quite successful. The extension to other types of obstacles, such as craters, was considered. The special problems of bottom edge detection and scanning procedure are discussed. Author

N74-31748# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Raumsimulation.

THE CONVERTER AS A DIRECTION-CONTROLLED SENSOR FOR MEASURING MOLECULAR FLOW FIELDS IN NONISOTHERMAL VACUUM FACILITIES Ph.D. Thesis - Tuebingen Univ., West Ger. [DER KONVERTER ALS RICHTUNGSABHAENGIGER SENSOR ZUR VERMESSUNG VON MOLEKUL-

ARSTROMFELDERN IN NICHTISOTHERMEN VAKUUMANLAGEN]
Peter Kleber 8 Oct. 1973 97 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-90) Avail: NTIS HC $8.00; DFVLR, Porz, West Ger. 34,60 DM

A converter has been used in a nonisothermal vacuum facility for measuring impact densities of molecular flow fields. In such a facility the state of a gas cannot be characterized by pressure and temperature. The converter, at a defined temperature of its chamber, can transform the molecular impact density on its orifice into a pressure indication of the built-in ionization gage. The converter is theoretically and experimentally investigated. The investigations are extended to the reading of open ionization gages in a nonisothermal environment. As an example, the molecular flow fields in the 2.5 m space simulation chamber of the DFVLR are investigated using GN2 and C2H5OH as test gases. Author (ESRO)

N74-31749# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
THE HIGH-TEMPERATURE HIGH PRESSURE COMBUSTION TEST RIG OF THE DFVLR INSTITUTE FOR AVIATION FUELS AND LUBRICANTS, AIR SUPPLY UNIT [DIE HOCHDRUCK-HOCHTEMPERATUR-BRENNSTRECKE DES DFVLR-INSTITUTS FUER FLUGTREIB- UND SCHMIERSTOFFE. DIE LUFTVERSORGUNGSANLAGE]
Hans Gemperlein and Fritz Koerber 9 Jan. 1974 60 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-74-06) Avail: NTIS HC $6.00; DFVLR, Porz, West Ger. 23,10 DM

Set-up of the air supply unit is outlined for a test rig which serves to test burning characteristics of aviation fuels at high pressures and temperatures. Unit design is for an intermitting operation according to the blow-down principle that allows test periods of several minutes at an air rate of maximum 6.5 kg air per second. Total pressures ahead of the combustion test rig are between 5 at and 20 at and total temperatures of air are between 300 C and 700 C. Outlay and description of the air supply unit components are presented. Special consideration of the correlative relationship is made. Start of unit operation is reported. Based on a diagram, the curves of important characteristic data during a test run are discussed. Author (ESRO)

N74-31750# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CENTRIFUGAL FAILURE OF A MAGNUS MODEL Final Memorandum Report
Anders S. Platou Apr. 1974 12 p refs
(AD-780734; BRL-MR-2367) Avail: NTIS CSCL 14/2

The report describes an accident which occurred during a wind tunnel Magnus test. The model reached its bursting speed, broke a test section window, and the resulting implosion imbedded glass splinters in the steel test section and nozzle walls. Better methods of calculating bursting speeds and of pre-spinning models to their design spin are required. Author (GRA)

N74-31751# Transit Development Corp., Washington, D.C.
THEORETICAL AERODYNAMIC CHARACTERISTICS OF VEHICLES IN CONFINED SPACES
Mar. 1974 40 p refs Prepared in cooperation with California Inst. of Technology, Pasadena
(Contract DOT-UT-290)
(PB-231385/6; UMTA-DC-06-0010-72-13) Avail: NTIS HC $3.25 CSCL 13F

The results of a theoretical effort pertaining to the nonsteady flow in a tunnel induced by a moving vehicle are described. A study is made of the entry problem and the problem of a vented tube. GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-31752*# Aerotherm Corp., Mountain View, Calif.
BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE CODE MODIFICATIONS AND VERIFICATIONS Final Report
R. Michael Evans and Howard L. Morse Mar. 1974 42 p refs
(Contract NAS8-29667; Aerotherm Proj. 6282)
(NASA-CR-120364; AEROTHERM-74-95) Avail: NTIS HC $5.25 CSCL 20D

A summary of modifications to Aerotherm's Boundary Layer Integral Matrix Procedure (BLIMP) code is presented. These modifications represent a preliminary effort to make BLIMP compatible with other JANNAF codes and to adjust the code for specific application to rocket nozzle flows. Results of the initial verification of the code for prediction of rocket nozzle type flows are discussed. For those cases in which measured free stream flow conditions were used as input to the code, the boundary layer predictions and measurements are in excellent agreement. In two cases, with free stream flow conditions calculated by another JANNAF code (TDK) for use as input to BLIMP, the predictions and the data were in fair agreement for one case and in poor agreement for the other case. The poor agreement is believed to result from failure of the turbulent model in BLIMP to account for laminarization of a turbulent flow. Recommendations for further code modifications and improvements are also presented. Author

N74-31753*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF INTERFERENCE-FREE NUMERICAL RESULTS WITH SAMPLE EXPERIMENTAL DATA FOR THE AEDC WALL-INTERFERENCE MODEL AT TRANSONIC AND SUBSONIC FLOW CONDITIONS
Perry A. Newman and Dennis O. Allison Jul. 1974 94 p
(NASA-TM-X-71991) Avail: NTIS HC $4.00 CSCL 20D

Numerical results obtained from two computer programs recently developed with NASA support and now available for use by others are compared with some sample experimental data taken on a rectangular-wing configuration in the AEDC 16-Foot Transonic Tunnel at transonic and subsonic flow conditions. This data was used in an AEDC investigation as reference data to deduce the tunnel-wall interference effects for corresponding data taken in a smaller tunnel. The comparisons were originally intended to see how well a current state-of-the-art transonic flow calculation for a simple 3-D wing agreed with data which was felt by experimentalists to be relatively interference-free. As a result of the discrepancies between the experimental data and computational results at the quoted angle of attack, it was then deduced from an approximate stress analysis that the sting had deflected appreciably. Thus, the comparisons themselves are not so meaningful, since the calculations must be repeated at the proper angle of attack. Of more importance, however, is a demonstration of the utility of currently available computational tools in the analysis and correlation of transonic experimental data. Author

N74-31754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-THREE-DIMENSIONAL FLOW SOLUTION BY MERIDIONAL PLANE ANALYSIS
Theodore Katsanis and William D. McNally 1974 30 p refs Proposed for presentation at the Natl. Aerospace Eng. Meeting, San Diego, Calif., 30 Sep. - 4 Oct. 1974; sponsored by SAE
(NASA-TM-X-71593; E-8084) Avail: NTIS HC $3.25 CSCL 20D

A computer program has been developed to obtain subsonic or shockfree transonic, nonviscous flow analysis on the hub-shroud mid-channel flow surface of a turbomachine. The analysis may be for any annular passage, with or without blades. The blades may be fixed or rotating and may be twisted and leaned. The

flow may be axial, radial or mixed. Blade surface velocities over the entire blade are approximated based on the rate of change of angular momentum. This gives a 3-D flow picture based on a 2-D analysis. The paper discusses the method used for the program and shows examples of the type of passages and blade rows which can be analyzed. Also, some numerical examples are given to show how the program can be used for practical assistance in design of blading, annular passages, and annular diffusers. Author

N74-31755*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HEAT-TRANSFER AND PRESSURE DISTRIBUTIONS FOR LAMINAR SEPARATED FLOWS DOWNSTREAM OF REARWARD-FACING STEPS WITH AND WITHOUT MASS SUCTION

Ronald D. Brown and Antoni K. Jakubowski (Virginia Polytechnic Inst. and State Univ.) Washington Aug. 1974 69 p refs (NASA-TN-D-7430; L-8790) Avail: NTIS HC $3.75 CSCL 20D

Heat-transfer and pressure distributions were measured for laminar separated flows downstream of rearward-facing steps with and without mass suction. The flow conditions were such that the boundary-layer thickness was comparable to or larger than the step height. For both suction and no-suction cases, an increase in the step height resulted in a sharp decrease in the initial heat-transfer rates behind the step. Downstream, however, the heat transfer gradually recovered back to less than or near attached-flow values. Mass suction from the step base area increased the local heat-transfer rates; however, this effect was relatively weak for the laminar flows considered. Even removal of the entire approaching boundary layer raised the post-step heat-transfer rates only about 10 percent above the flatplate values. Post-step pressure distributions were found to depend on the entrainment conditions at separation. In the case of the solid-faced step, a sharp pressure drop behind the step was followed by a very short plateau and relatively fast recompression. For the slotted-step connected to a large plenum but without suction, the pressure drop at the base was much smaller and the downstream recompression more gradual than that for solid-faced step. Author

N74-31756*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

REARWARD-FACING STEPS IN LAMINAR SUPERSONIC FLOWS WITH AND WITHOUT SUCTION

A. K. Jakubowski and C. H. Lewis [1974] 84 p refs (Grant NGR-47-004-070)
(NASA-CR-132476) Avail: NTIS HC $7.25 CSCL 20D

An experimental investigation of heat-transfer and pressure distributions within regions of laminar separated flows produced by two-dimensional rearward-facing steps has been carried out at freestream Mach numbers of around 4 in the range of step height-to-boundary layer thickness varying from 0.1 to 2.4. With no suction from the separated area, the ratio of the maximum post-step heat transfer to the attached-flow values was less than unity. The maximum heating-rate region was located far downstream of the reattachment plate stagnation point. Mass suction from the separated area increased the local heating rates, this effect was however relatively weak for purely laminar flow conditions and the competing effect of the step height clearly predominated. At step heights comparable with boundary-layer thickness, even removing the entire approaching boundary layer was not sufficient to raise the post-step heating rates above the flat-plate values. Author

N74-31757# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

ATTENUATION OF PRESSURE AND DENSITY FLUCTUATIONS IN TRANSONIC JETS BY CONDENSATED WATER VAPOUR

Manfred Jaeschke Jun. 1974 140 p refs. Revised
(Ber-31/1974-Rev; Ber-57/1973) Avail: NTIS HC $10.00

An experimental and theoretical investigation of unsteady shock waves in transonic jets was carried out. A considerable reduction of the strength of these waves was observed as the air moisture increases. A half free jet was formed in a plane LAVAL type nozzle by separating the flow on one side of the contour. Both upstream and downstream moving disturbances were studied; the upstream moving disturbances were mostly reduced. The amplitude damping coefficients of the disturbances were determined by measuring the decay along their direction of propagation at the downstream end of the flow, by exploding a thin copper wire with an electrical discharge, which corresponds to the attenuation of the natural disturbances. Further experiments showed that the presence of condensed vapor is essential for the observered attenuation. The droplet size was calculated by an one dimensional streamline theory using experimentally determined pressure and density curves in the nozzle. Author

N74-31758*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INVESTIGATION OF AN ANOMALOUS FLOW CONDITION OF THE LANGLEY PILOT MODEL EXPANSION TUBE

Wilfred J. Friesen Washington Aug. 1974 44 p refs (NASA-TN-D-7704; L-9633) Avail: NTIS HC $3.25 CSCL 20D

Free-stream flow velocity measurements were made in the Langley pilot model expansion tube during the test flow interval. During this interval, an anomalous dip in pitot pressure occurs for the expansion tube operating conditions employed. Within the test flow interval, the main conclusions reached from comparison of the measured flow velocity, pitot pressure, and tube wall pressure are: the variations which occur in velocity and wall pressure are small compared with the variations in pitot pressure; a corresponding dip in the derived flow density is associated with the dip in pitot pressure; and the value of the average density over the interval, which results from the expansion from the shocked intermediate chamber condition, is approximately one-half of the value that can result from only an isentropic process. Author

N74-31759*# Stanford Univ., Calif. Thermoscience Div.

TURBULENT TRANSPORT OF HEAT AND MOMENTUM IN A BOUNDARY LAYER SUBJECT TO DECELERATION, SUCTION AND VARIABLE WALL TEMPERATURE

A. F. Orlando, R. J. Moffat, and W. M. Kays May 1974 220 p refs
(Grant NGR-05-020-134; Contract N00014-67-A-0112-0072)
(NASA-CR-139655; SU-HMT-17) Avail: NTIS HC $14.00 CSCL 20D

The relationship between the turbulent transport of heat and momentum in an adverse pressure gradient boundary layer was studied. An experimental study was conducted of turbulent boundary layers subject to strong adverse pressure gradients with suction. Near-equilibrium flows were attained, evidenced by outer-region similarity in terms of defect temperature and defect velocity profiles. The relationship between Stanton number and enthalpy thickness was shown to be the same as for a flat plate flow both for constant wall temperature boundary conditions and for steps in wall temperature. The superposition principle used with the step-wall-temperature experimental result was shown to accurately predict the Stanton number variation for two cases of arbitrarily varying wall temperature. The Reynolds stress tensor components were measured for strong adverse pressure gradient conditions and different suction rates. Two peaks of turbulence intensity were found: one in the inner and one in the outer regions. The outer peak is shown to be displaced outward by an adverse pressure gradient and suppressed by suction. Author

N74-31760*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTERFERENCE HEATING FROM INTERACTIONS OF SHOCK WAVES WITH TURBULENT BOUNDARY LAYERS AT MACH 6

Charles B. Johnson and Louis G. Kaufman, II (Grumman Aerospace Corp.) Washington Sep. 1974 73 p refs
(NASA-TN-D-7649; L-9458) Avail: NTIS HC $3.75 CSCL 20D

An experimental investigation of interference heating resulting from interactions of shock waves and turbulent boundary layers was conducted. Pressure and heat-transfer distributions were measured on a flat plate in the free stream and on the wall of the test section of the Langley Mach 6 high Reynolds number tunnel for Reynolds numbers ranging from 2 million to

400 million. Various incident shock strengths were obtained by varying a wedge-shock generator angle (from 10 deg to 15 deg) and by placing a spherical-shock generator at different vertical positions above the instrumented flat plate and tunnel wall. The largest heating-rate amplification factors obtained for completely turbulent boundary layers were 22.1 for the flat plate and 11.6 for the tunnel wall experiments. Maximum heating correlated with peak pressures using a power law with a 0.85 exponent. Measured pressure distributions were compared with those calculated using turbulent free-interaction pressure rise theories, and separation lengths were compared with values calculated by using different methods. Author

N74-31761*# Techtran Corp., Glen Burnie, Md.
APPLICATION OF A THEOREM ON THE ZEROS OF STOCHASTIC FUNCTIONS TO TURBULENCE MEASUREMENTS
H. W. Liepmann Washington NASA Sep. 1974 11 p refs Transl. into ENGLISH from Helv. Phys. Acta (Switzerland), v. 22, no. 2, 18 Mar. 1949 p 119-126
(Contract NASw-2485)
(NASA-TT-F-15842) Avail: NTIS HC $4.00 CSCL 20D

The mean number of null-positions of a stochastic function is related directly to the mean square of their derivative. If this theorem is used on the components of the fluctuation rate in isotropic turbulence, then using certain assumptions, the length characteristic can be determined for the dissipation by counting the number of zero-positions. Measurements of this kind have been made, and the results were compared with three other independent determinations. Author

N74-31762*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATIONAL RELAXATION IN EXPANDING N2 AND AIR
Daniel I. Sebacher and Robert W. Guy Aug. 1974 22 p refs
(NASA-TM-X-71988) Avail: NTIS HC $3.00 CSCL 20D

New N2 vibrational temperature data, obtained in expanding N2 and air using the electron beam technique, are analyzed permitting the vibrational relaxation times to be determined as a function of temperature. In addition, the effects on N2 vibrational relaxation times of direct vibrational energy transfer between N2 and H2O, between N2 and O2, and between N2 and free electrons introduced from arc contaminants are analyzed. The vibrational relaxation times determined from the present measurements agree with those measured in the expanding flows of shock tunnels and impact tubes. These expanding data also agree with relaxation times observed in acoustical resonant cavities where alternating compressions and expansions take place. The relaxation times in expanding flows (vib-tran exchange process) are found to be approximately 50 times faster than those measured in the compressing flow of shock tubes (tran-vib exchange process). This evidence strongly supports the concept that one relaxation time distribution cannot be applied to both exchange processes. Author

N74-31763*# Kanner (Leo) Associates, Redwood City, Calif.
AN IMPLICIT SYSTEM FOR CALCULATION OF FLOW OF A VISCOUS, HEAT-CONDUCTING GAS
Yu. A. Berezin, V. M. Kovenya, and N. N. Yanenko Washington NASA Aug. 1974 20 p refs Transl. into ENGLISH from Chislennyye Metody Mekh. Sploshnoy Sredy, v. 3, no. 4, 1972 p 3-18
(Contract NASw-2481)
(NASA-TT-F-15882) Avail: NTIS HC $4.00 CSCL 20D

An implicit difference scheme of separation of first order accuracy by three-dimensional variables having total approximation, is constructed for a system of equations describing plane flow of a viscous, compressible, heat-conducting gas. Absolute stability of the scheme was demonstrated by the Fourier method and calculations showed that the scheme is stable at least up to Kurant number K = 10. Data and curves are presented on calculations in a steady flow around a wedge and a plate at various angles of attack, Mach and Reynolds numbers, taking account of the associated shock wave, vortex zone and rarefaction zone. Author

N74-31764*# Scientific Translation Service, Santa Barbara, Calif.
EXTERNAL SOUND FIELD EFFECT ON A TURBULENT BOUNDARY LAYER
P. Gougat Washington NASA Sep. 1974 113 p refs Transl. into ENGLISH of "Influence d'un Champ Acoustique Exterieur sur une Couche Limite Turbulente", Rept. 70-8 CNRS, Meudon, France, Sep. 1970 p 103
(Contract NASw-2483)
(NASA-TT-F-15841; Rept-70-8) Avail: NTIS HC $8.75 CSCL 20D

The response of a boundary layer to harmonic oscillations was analyzed in terms of the influence of an acoustic field on heat exchange in a turbulent boundary layer on a flat plate. Wind tunnel tests were performed using a hot-wire anemometer linked to a Wheatstone bridge. It is shown that an ultrasonic field is not appropriate, and that with the wind tunnel used, measurements were not possible for low frequencies. Author

N74-31765*# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A SURVEY OF INCOMPRESSIBLE, TWO-DIMENSIONAL UNSTEADY BOUNDARY LAYERS
P. Royle Mar. 1974 23 p refs Sponsored jointly by Natl. Gas Turbine Estab., UK, and NASA
(NASA-CR-139883; TT-7402) Avail: NTIS HC $4.25

The principal features of incompressible unsteady boundary layer analysis have been outlined, and it is evident from the works described that the most important properties were discovered by Stokes and Rayleigh prior to Prandth's boundary layer theory. Little theoretical work has been done on turbulent boundary layers, because its nonlinearity obviates exact or simple approximated solutions. It is pointed out that probably the most important unsteady boundary layer effect resulted from separation point motion thus allowing viscous-inviscid interaction. ESRO

N74-31766# Sandia Labs., Albuquerque, N.Mex.
STUDY OF BASE PRESSURE IN LAMINAR HYPERSONIC FLOW: REENTRY FLIGHT EXPERIMENTS
B. M. Bulmer 1974 20 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974 Sponsored by AEC and US Air Force
(SLA-73-5298; Conf-740114-1) Avail: NTIS HC $3.00

The results on laminar hypersonic base pressure data from four reentry flight tests are discussed for flight conditions which are representative of advanced reentry vehicle systems. Analyses of the data utilize correlation parameters derived from experimental ground test results. The flight data are compared with theory, and ground-and flight-test data for similar configurations. Correlations of the data are studied to establish a basis for reentry vehicle preflight predictions, and postflight analysis, and base pressure predictions are developed for slender configurations. A parametric study is included to show real-gas and nose-bluntness effects on the base pressure of a slender cone.
Author

N74-31767# Politecnico di Torino (Italy). Ist. di Macchine et Motori per Aeromobili.
NUMERICAL ANALYSIS OF THE SUPERSONIC FLOW ABOUT ELLIPTICAL CONES
Maurizio Pandolfi Feb. 1974 33 p refs
(Contract CNR-115.6799-73.00171.07)
(Publ-157) Avail: NTIS HC $4.75

The three dimensional supersonic flow about elliptical cones is studied. The elliptical bodies are initialized by circular noses, a pointed cone, or a sphere. The integration of the hyperbolic partial differential equations, which describe the motion, is carried out by a finite difference method. The bow shock is treated as a discontinuity during its evolution. Particular attention is paid to overcome the numerical problems due to the formation of both entropy layers and entropy singularities. The results are compared with the ones obtained by independent calculations and with experimental data. Author (ESRO)

N74-31768# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A REVIEW OF THE CURRENT CONCEPT OF CASCADE SECONDARY FLOW EFFECTS
J. W. Salvage Mar. 1974 110 p refs

(VKI-TN-95) Avail: NTIS HC $8.50

The literature on secondary flow effects in plane compressor cascades without tip clearance was reviewed. It was found that the secondary flow can create a very large local disturbance, even upon the inviscid core flow, and that secondary flow shows a three dimensional behavior. Some elementary information about a particular class of three dimensional boundary layer flows is given. ESRO

N74-31769# Institut Franco-Allemand de Recherches, St. Louis (France).

INVESTIGATION OF THE AXIAL VELOCITY FIELD IN A SUPERSONIC FREE JET [UNTERSUCHUNG DES AXIALEN GESCHWINDIGKEITSF ELDES IN EINEM UEBERSCHALLFREISTRAHL]

H. J. Pfeifer, H. D. VonStein, and B. Koch 18 Jun. 1973 21 p refs In GERMAN

(ISL-30/73) Avail: NTIS HC $4.25

Experimental investigations of a supersonic free jet escaping from a non divergent nozzle into the free atmosphere are described. The free jet of 40 mm diameter was produced by a shock tube. The Mach number at the jet boundary was 1.29; the gust duration about 1 ms. The axial flow field was determined with a laser Doppler velocimeter, which has an error of 1%, for velocity measurements of a volume of 0.2 cu mm. ESRO

N74-31770# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. Fuer Turbulenzforschung.

THE INFLUENCE OF THE FLOW AROUND A MICROPHONE ON IN-DUCT FAN-NOISE MEASUREMENTS Ph.D. Thesis - Tech. Univ., Berlin

Wolfgang Neise 1974 118 p refs In GERMAN; ENGLISH summary

(DLR-FB-74-04) Avail: NTIS HC $9.00; DFVLR, Porz, West Ger. 37,70 DM

When sound measurements are made in flow ducts a sufficient signal-to-noise-ratio has to be provided between the desired sound waves and the undesirable turbulent pressure fluctuations, which the flow excites at the microphone. Experimental results for the level and spectral distribution of the turbulent noise signal are reported as a function of the mean flow velocity, of the intensity of the turbulence, and of the duct diameter. Theoretical and experimental investigations show that the turbulent noise signal at the microphone can be reduced considerably by means of a cylindrical tube with porous walls. The signal-to-noise-ratio between sound and flow noise increases with both frequency and tube length; it becomes smaller for higher flow velocities. The acoustic flow resistance of the porous wall may be varied within a wide range without diminishing the efficiency of the flow noise suppressor. Author (ESRO)

N74-31771# European Space Research Organization, Paris (France).

PLANE AND AXISYMMETRIC NON-VISCOUS HYPERSONIC FLOW WITH HIGH COMPRESSION IN THE DETACHED SHOCK WAVE OF A GIVEN BODY

Alfred Baston May 1974 199 p refs Transl. into ENGLISH of Ebene u. Achsensymmetrische, Reibungsfreie Hyperschall-Istroemung mit Hoher Verdichtung in der Kopfwelle eines Vorgegebenen Koerpers, DLR-FB-73-75, DFVLR, 7 Jun. 1973 (ESRO-TT-53; DLR-FB-73-75) Avail: NTIS HC $12.00; DFVLR, Porz, West Ger. 48,20 DM

The solution of the direct problem is found by using a uniformly valid, analytic, approximate solution of the inverse problem for non-viscous hypersonic flow. Velocity and density are assumed to have linear dependence on the stream function. The formulation of the direct problem leads to a system of ordinary differential equations in tangential direction. The use of the stream function in the linear expressions for velocity and density has the advantage that this system of differential equations can be used in the whole flow field; that means in the local subsonic and the supersonic regions. An iterative procedure similar to the Dorodnitsyn method is employed to solve it numerically. Numerical results are given and discussed for ideal gases with constant specific heats. Author (ESRO)

N74-31772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL STUDY OF CRITICAL GAS EJECTOR REGIMES UNDER NEGATIVE EJECTION COEFFICIENTS

A. N. Timoshin 23 Apr. 1974 14 p refs Transl. into ENGLISH from Lopatochnye Mashiny i Struynye App. Sb. Statei (USSR), no. 6, 1972 p 211-224

(AD-780366; FTD-HT-23-679-74) Avail: NTIS CSCL 20/4

The work of a gas ejector under negative ejection coefficients was studied in critical and precritical regimes, where the return flow from the mixing chamber was created by increasing the counterpressure. The experimental unit was comprised of a high head gas nozzle, a vacuum chamber, a metering nozzle for measuring flow rate of gas drawn out, and a mixing chamber. The gas expansion ratio was determined by the influx conditions of the supersonic stream on the wall of the mixing chamber. The degree of gas expansion for both supersonic ejectors and precritical regimes is described, and the values are shown for the magnitude of relative pressure which is required to maintain the critical regime. A.A.D.

N74-31773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHARACTERISTICS OF DIFFUSERS IN SHOCK TUBE

V. M. Anufriev, G. I. Kozlov, and D. K. Roitenburg 23 Apr. 1974 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 1, Jan. - Feb. 1972 p 156-161

(AF Proj. G101)

(AD-780376; FTD-HT-23-1976-74) Avail: NTIS CSCL 21/5

A study was done on diffuser starting in a shock tube at M=8 at variable Re numbers, and the throttling characteristics were recorded. GRA

N74-31774# Naval Ship Research and Development Center, Bethesda, Md.

DIVERGENCE ANALYSIS OF SWEPT HYDROFOILS--COMPUTER PROGRAM (SWDIVRG) Final Report

John R. Caspar Apr. 1974 79 p refs

(AD-779844; NSRDC-4245) Avail: NTIS CSCL 13/10

A systematic approach is described by which divergence characteristics of swept or unswept hydrofoils may be calculated. The computer program, called SWDIVRG, developed to do the calculations makes use of a lumped-parameter approach, resulting in a matrix solution of the system. The bending and torsional displacements any of N stations along the hydrofoil span can be calculated at speeds less than divergence. Bending and torsional moments can be calculated for the condition of cantilever-beam constraints. The divergence speed is principally computed by an eigenvector iteration scheme. A convenient formulation and a plot are provided for estimating the hydrodynamic loading parameters for finite-span, surface-piercing hydrofoils. Also, a useful closed-form divergence formulation, which considers submergence level, has been derived for the special case of a uniform cantilever strut or foil. Test calculations of airfoil models and one hydrofoil model, using both SWDIVRG and the closed-form solution, show good agreement with experimental model-divergence speeds. Author (GRA)

N74-31775# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

TRANSONIC FLOW COMPUTATION IN ANNULAR AND UNSYMMETRIC TWO-DIMENSIONAL NOZZLES Interim Report, 26 Aug. 1971 - Jun. 1973

H. Doyle Thompson and Ronald D. Flack 28 Dec. 1973 91 p refs

(Contract DAAH01-72-C-0089; DA Proj. 1M2-62303-A-214) (AD-780721; RD-73-21) Avail: NTIS CSCL 20/4

An analytical model has been formulated and a computer program has been developed to compute the transonic flow field in either two-dimensional or annular axisymmetric nozzles. The analytical model assumes the inviscid, irrotational flow of a perfect gas, and is based on a Taylor series expansion around a Mach number of unity. An expansion parameter, epsilon is defined in terms of the wall geometry at the minimum area cross section. The method is capable of treating unsymmetric wall geometries. First, second, or third order solutions can be

obtained from the computer program. (Modified author abstract) GRA

N74-31776# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
THE VISCOUS INTERACTION OF INCOMPRESSIBLE SEPARATED FLOWS (REVISED EDITION)
Wen L. Chow and Donald J. Spring 31 May 1974 29 p refs Revised
(DA Proj. 1M2-62303-A-214)
(AD-780710; RD-73-22-Rev) Avail: NTIS CSCL 20/4

A mathematical model for the calculation of the viscous interaction of incompressible flows is derived. The particular application discussed is for two-dimensional, incompressible flows over a back step. Use is made of conformal mapping and free-streamline theory in conjunction with a reattachment analysis previously derived for supersonic flows. Author (GRA)

N74-31777# Naval Ordnance Lab., White Oak, Md.
INTERACTING SUPERSONIC TURBULENT BOUNDARY LAYERS OVER A TWO-DIMENSIONAL PROTUBERANCE
Arnold Polak 21 Jan. 1974 25 p refs
(AD-780691; NOLTR-74-16) Avail: NTIS CSCL 20/4

The report presents a numerical study of attached interacting supersonic turbulent boundary layers over a two-dimensional protuberance. Results are presented in terms of surface pressure, heat transfer and skin-friction distributions. These results indicate a strong effect of the size of the protuberance, Mach number, but a weak effect of Reynolds number and the ratio of wall-to-recovery temperature. The peak heating rates from a set of test cases compare well to a semi-empirical prediction method. In contradistinction to the laminar case, the turbulent recovery zone downstream of the protuberance is very short.
Author (GRA)

N74-31778# Naval Ship Research and Development Center, Bethesda, Md.
HYDROELASTIC DESIGN OF SUBCAVITATING AND CAVITATING HYDROFOIL STRUT SYSTEMS
Peter K. Besch and Yuan-Ning Liu Apr. 1974 88 p refs
(AD-780776; NSRDC-4257) Avail: NTIS CSCL 13/10

The report presents design procedures and parametric trends that can be used to avoid flutter and divergence of hydrofoil strut-foil systems. Flutter stability of conventional T-foils can be achieved by scaling existing prototype systems which are stable; scaled flutter models must be used to determine the stability of new designs. Several stable T-foil designs are available for craft with displacements of up to 300 tons at subcavitating speeds (below 50 knots). The availability of higher speed designs for ships of practical size is limited to one system that is stable to 62 knots. Divergence stability of subcavitating systems can be ensured by theoretical analysis using an available computer program. Author (GRA)

N74-31779# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
EXPERIMENTAL STUDY OF FLOW FIELD PRODUCED WHEN AN UNDEREXPANDED JET EXHAUSTS INTO A CONSTRICTIVE, STEPPED LAUNCH TUBE
John J. Bertin, M. Kathy Horn, and Thomas L. Webber Jan. 1974 112 p refs
(Contract DAAH01-73-C-1016)
(AD-780951; Rept-74002) Avail: NTIS CSCL 19/7

An underexpanded, supersonic jet of cold nitrogen was exhausted into a constrictive, stepped launch tube. For one launch tube, the reduction in cross section was accomplished abruptly by a rectangular step. For the other launch tube, the reduction in cross section was accomplished gradually by a 15 degree-ramp. Thirty-seven static-pressure orifices were located along the walls of the two tubes. By varying the location of the nozzle exit-plane with respect to the step location, one could simulate (in a quasi-steady manner) the effect of movement of the rocket through the launch tube. Pitot probes located in the annular region between the simulated rocket-nozzle and the launch tube provided information about the reverse, or blow-by, flow created when the nozzle exhaust encountered the constriction. (Modified author abstract) GRA

N74-31780# Denver Research Inst., Colo. Div. of Mathematical Sciences.
AN ANALYSIS OF SCALING FOR LINEAR INVISCID INTERNAL WAVES Final Report
N. Bleistein and J. K. Cohen 24 Jul. 1973 22 p refs Supersedes AD-764579, N73-33227
(Contract N00014-67-A-0394-0005; NR Proj. 041-434)
(AD-780867; MS-R-7401A; AD-764579) Avail: NTIS CSCL 20/4

A consistent scaling is developed for the study of linear inviscid internal waves in the ocean, the atmosphere or experimental tanks. There are scales to characterize the linearization, the slow variation of the amplitude, the stratification scale, modal versus nonmodal flow and transverse variation of the ambient density and pressure. Observations in the ocean, the atmosphere and tank experiments are cited both for motivation and corroboration. Author (GRA)

N74-31781*# Pennsylvania State Univ., University Park. Applied Research Lab.
THE EFFECT OF GAS DIFFUSION AND VAPORIZATION ON THE ENTRAINMENT COEFFICIENT FOR A VENTILATED CAVITY
Michael L. Billet and Donald S. Weir 24 Jan. 1974 31 p refs
(Grant NGL-39-009-001; Contract N00017-73-C-1418)
(NASA-CR-139660; AD-780950; TM-74-15) Avail: NTIS HC $4.75 CSCL 20/4

A method is presented for determining the effect of gas diffusion and vaporization on the volume flowrate of gas needed to sustain a ventilated cavity. The analysis for the gas diffusion effect is based on a mathematical model of diffusion which accounts for changes in flow velocity, body scale, model geometry, and air content. Experimental studies compare favorably with the analysis. Also, a scaling relationship is proposed for ventilated cavity flows. Author (GRA)

N74-31734 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EFFECTS OF FLOW TURBULENCE AND NOISE AND AERODYNAMIC PHENOMENA AND WINDTUNNEL RESULTS
R. Michel *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 27 p refs In ENGLISH and FRENCH (For availability see N74-31733 21-11)

N74-31735 Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
NOTES CONCERNING TESTING TIME REQUIREMENTS IN STEADY AND UNSTEADY MEASUREMENTS
J. W. G. VanNunen *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 19 p (For availability see N74-31733 21-11)

N74-31739 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
ADDENDUM TO A SURVEY OF CORRECTING WALL CONSTRAINTS IN TRANSONIC WINDTUNNELS
J. C. Vayssaire *In* AGARD Large Windtunnels: Required Characteristics and the Performance of Various Types of Transonic Facility Jun. 1974 21 p refs (For availability see N74-31733 21-11)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-31782 Department of Energy, Mines and Resources, Ottawa (Ontario).
A THEORETICAL EVALUATION OF DESIGN GROUND SEISMIC MOTIONS FOR PIPELINES IN THE YUKON TERRITORY AND MACKENZIE VALLEY Publications of the

Earth Physics Branch, Vol. 44, No. 12
H. S. Hasegawa 1974 14 p refs
Copyright. Avail: NTIS Avail: Issuing Activity

A proposed Mackenzie Valley pipeline route is partitioned into three seismic zones that are related to the calculated acceleration contours for a 100-year-return period of Stevens and Milne. A set of design ground seismic motion parameters is calculated for each zone. The magnitude of these ground motion parameters should be thought of as sustained vibrations that are representative of the seismic activity to be expected on firm ground for the specified return period. Isolated extreme peaks could be a factor of four or even five times greater. For the section of the proposed corridor where the acceleration contours reach their largest value (west of Fort McPherson in the Richardson Mountains), a set of design ground seismic motion is as follows: 0.25g, 30 cm/sec (12 inches/sec) and 30 cm (12 inches) for ground acceleration, velocity and displacement respectively. Author

N74-31783 Department of Energy, Mines and Resources, Ottawa (Ontario).
A THREE-COMPONENT AEROMAGNETIC SURVEY OF BRITISH COLUMBIA AND THE ADJACENT PACIFIC OCEAN Publications of the Earth Physics Branch, Vol. 44, No. 14
W. Hannaford and G. V. Haines 1974 56 p refs
Copyright. Avail: Issuing Activity CSCL 08N

The geomagnetic components D,H,Z, and the total intensity F were measured at 4.6 km to 6.2 km altitude along flight lines traversing British Columbia and extending 1,400 km westward over the Pacific. The determination of systematic errors, mainly due to aircraft magnetic fields, is described. The corrected data, reduced to sea level and averaged over five-minute intervals, are listed. Further smoothing was applied to produce contoured charts of D,H,Z, and the Z anomaly field. Some features of the Z anomaly chart are discussed. One anomaly, prominent over a large area in northeasten British Columbia is fitted by models and compared with Precambrian Shield anomalies of similar scale reported by others. IGRF residuals derived from the five-minute averages are shown as profiles in D,H,Z, and F. The regional field, in the form of a 3rd-degree polynomial, is compared with IGRF. Author

N74-31784 Department of Energy, Mines and Resources, Ottawa (Ontario).
RECORD OF OBSERVATIONS AT VICTORIA MAGNETIC OBSERVATORY, 1972 Publications of the Earth Physics Branch, Vol. 44, No. 13
P. R. Auld and C. W. Walker 1974 56 p refs
Copyright. Avail: Issuing Activity

Declination, inclination; and total magnetic force-measurements were used to compute horizontal and vertical components. A summary of annual mean values for 1971.5 to 1972.5 shows a declination increase of 2.8 minutes, a 15 gamma increase in horizontal intensity, and a 14 gamma decrease in the vertical component. Author

N74-31785*# Alaska Univ., Fairbanks. Inst. of Water Resources.
A STUDY OF THE BREAK-UP CHARACTERISTICS OF CHENA RIVER BASIN USING ERTS IMAGERY Final Report, Jul. 1972 - Nov. 1973
Robert F. Carlson, Principal Investigator, Douglas L. Kane, and Gerd Wendler 14 Dec. 1973 38 p refs ERTS
(Contract NAS5-21833)
(E74-10675; NASA-CR-139242) Avail: NTIS HC $5.00 CSCL 08H

The author has identified the following significant results. The Chena River Basin was selected because of the availability of ground truth data for comparison. Very good agreement for snow distribution and rates of ablation was found between the ERTS-1 imagery, the snowmelt model, and field measurements. Monitoring snowmelt rates for relatively small basins appears to be practical. The main limitation of the ERTS-1 imagery is the interval of coverage. More frequent overflights providing coverage are needed for the study of transient hydrologic events. ERTS-1 data is most useful when used in conjunction with snowmelt prediction models and existing snow course data. These results should prove very useful in preliminary assessment of hydrologic conditions in ungaged watersheds and will provide a tool for month-to-month volume forecasting.

N74-31786*# National Center for Earthquake Research, Menlo Park, Calif.
DEVELOPMENT AND EVALUATION OF A PROTOTYPE GLOBAL VOLCANO SURVEILLANCE SYSTEM UTILIZING THE ERTS-1 SATELLITE DATA COLLECTION SYSTEM Final Report, Jun. 1972 - Feb. 1974
Jerry P. Eaton, Principal Investigator, Peter L. Ward, Elliot T. Endo, David H. Harlow, Rex Allen, and Dan Marquez Feb. 1974 168 p refs ERTS
(NASA Order S-70243-AG-2)
(E74-10689; NASA-CR-139222) Avail: NTIS HC $11.50 CSCL 08F

There are no author-identified significant results in this report.

N74-31787*# Kansas Univ., Lawrence.
THE UTILITY OF SKYLAB S-190A AND B FOR MEASURING WATER QUALITY PARAMETERS IN KANSAS RESERVOIRS
Harold L. Yarger, Principal Investigator and James R. McCauley 15 Aug. 1974 12 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13271)
(E74-10696; NASA-CR-139537) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-31788*# Agricultural Research Service, Weslaco, Tex.
REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Jun. - 19 Aug. 1974
Craig L. Wiegand, Principal Investigator Aug. 1974 6 p refs ERTS
(NASA Order S-70251-AG)
(E74-10706; NASA-CR-139539; PR-8) Avail: NTIS HC $4.00 CSCL 20F

The author has identified the following significant results. The majority of the rangelands of Hidalgo County, Texas are used in cow-calf operations. Continuous year-long grazing is practiced on about 60% of the acreage and some type of deferred system on the rest. Mechanical brush control is used more than chemical control. Ground surveys gave representative estimates for 15 vegetable crops produced in Hidalgo County. ERTS-1 data were used to estimate the acreage of citrus in the county. Combined Kubleka Munk and regression models, that included a term for shadow areas, gave a higher correlation of composite canopy reflectance with ground truth than either model alone.

N74-31789*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Jul. 1974
Roger M. Hoffer, Principal Investigator Jul. 1974 3 p EREP
(Contract NAS9-13380)
(E74-10707; NASA-CR-139540) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-31790*# Earth Satellite Corp., Washington, D.C.
LAND USE STUDIES WITH SKYLAB DATA, AUGUST 1974 Interim Report, Aug. 1974
David S. Simonett, Principal Investigator and Wayne G. Rohde Aug. 1974 61 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13314)
(E74-10709; NASA-CR-139542) Avail: NTIS HC $6.25 CSCL 08B

The author has identified the following significant results. Capabilities of Skylab photographic data suggest significant applications for: (1) identification and mapping of all primary, most secondary, and many tertiary land use classes; (2) stratification of the landscape for more detailed sampling; and (3) rapid updating of existing land use and vegetation maps subscaled at 1:25,000 and smaller with manual interpretation techniques. Automated thematic mapping of land use categories with electronic data processing techniques is feasible with the S-192 multispectral scanner, despite the high noise levels in many channels.

N74-31791*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
Mark F. Meier, Principal Investigator 1 Jul. 1974 7 p ERTS (NASA Order S-70243-AG-2)
(E74-10710; NASA-CR-139543) Avail: NTIS HC $4.00 CSCL 08L

The author has identified the following significant results. Snowlines on a small (6 sq km) drainage basin were accurately measured without use of digital processing, and snow patches as small as 150 m (maximum dimension) were correctly identified, proving that the resolution of ERTS is ample for snow mapping needs. The area of snow cover on 10 individual drainage basins in the North Cascades, Washington, has been determined at 12 different times; these data can be used for more accurate forecasts of streamflow. Progress has been made in distinguishing snow in trees using multispectral analysis. Motion of the surging Tweedsmuir Glacier was measured. Velocities ranged from 2 to 88 m per day; a zone of intense crevassing also appeared to spread up and down the glacier (at about 200 m per day upglacier). This tentative result may be of great importance to an understanding of surging glacier dynamics. ERTS images also show that the most recent debris flow (20-21 August 1973) from Mount Baker can be clearly discerned and mapped, in order to monitor this potential hazard.

N74-31792*# Alaska Univ., Fairbanks. Inst. of Marine Science.
SEA-SURFACE CIRCULATION, SEDIMENT TRANSPORT, AND MARINE MAMMAL DISTRIBUTION, ALASKA CONTINENTAL SHELF Final Report, Jul. 1972 - Jan. 1974
F. F. Wright, Principal Investigator, G. D. Sharma, J. J. Burns, and D. C. Burbank 5 Feb. 1974 84 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21833)
(E74-10711; NASA-CR-139544) Avail: NTIS HC $7.25 CSCL 08C

There are no author-identified significant results in this report.

N74-31793*# Geological Survey, Reston, Va. Geographic Applications Program.
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE (CARETS): A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM Progress Report, 1 Sep. - 31 Oct. 1973
Robert H. Alexander, Principal Investigator 1 Nov. 1973 24 p ERTS
(NASA Order S-70243-AG-3)
(E74-10712; NASA-CR-139545) Avail: NTIS HC $4.25 CSCL 05B

There are no author-identified significant results in this report.

N74-31794*# Geological Survey, Reston, Va.
THE CARTOGRAPHIC APPLICATION OF ERTS/RBV IMAGERY IN POLAR REGIONS Progress Report, 1 Mar. - 30 Apr. 1974
William R. MacDonald, Principal Investigator 1 May 1974 5 p ERTS
(NASA Order S-70243-AG-2)
(E74-10713; NASA-CR-139546) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. A 1:1,000,000 scale sketch map has been prepared from ERTS imagery of the Prince Olav Coast, Antarctica. This is the first such mapping of the extent of the ice tongues of the Shtrase and Fietta Bay glaciers. Shtrase is of particular interest because the ERTS imagery shows the tongue extending out into the Lutzom-Holm Bay approximately 32 miles further than ever depicted on existing maps. This sketch map and others in work covering coastal areas of the Antarctic continent show many coastal changes when compared to what is believed to be the most current published maps. These sketch maps along with the accompanying mosaics will be a bench mark for future revision to existing maps and charts and also an invaluable source for mew mapping. ERTS imagery is now available over Mt. Siple, Antarctica, and it is expected to provide a source to position Mt. Siple correctly in relation to the Executive Committee Range. A mosaic at 1:500,000 scale is also being compiled that will serve as a source for future revision of 1:250,000 scale maps of the Ellsworth Mountains, change and improve the shape and size of the islands within the Ronne Ice Shelf, and redefine the ice front of the Ronne and Filchner Shelves.

N74-31795*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
GROUND PATTERN ANALYSIS IN THE GREAT PLAINS Final Report, 1 Aug. 1972 - 15 May 1974
John C. Davis, Fawwaz T. Ulaby, Principal Investigator, and James L. McNaughton May 1974 84 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21822)
(E74-10714; NASA-CR-139553) Avail: NTIS HC $7.25 CSCL 08B

There are no author-identified significant results in this report.

N74-31796*# Bendix Corp., Ann Arbor, Mich. Systems Div.
AUTOMATIC MAPPING OF STRIP MINE OPERATIONS FROM SPACECRAFT DATA
Robert H. Rogers, Principal Investigator, Larry E. Reed, and Wayne A. Pettyjohn (Ohio State Univ.) Aug. 1974 17 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21762)
(E74-10715; NASA-CR-139547) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Computer techniques were applied to process ERTS tapes acquired over coal mining operations in southeastern Ohio on 21 August 1972 and 3 September 1973. ERTS products obtained included geometrically-correct map overlays, at scales from 1:24,000 to 1:250,000, showing stripped earth, partially reclaimed earth, water, and natural vegetation. Computer-generated tables listing the area covered by each land-water category in square kilometers were also produced. By comparing these mapping products, the study demonstrates the capability of ERTS to monitor changes in the extent of stripping and reclamation. NASA C-130 photography acquired on 7 September 1973 when compared with the ERTS products generated from the 3 September 1973 tape established the categorization accuracy to be better than 90%. It is estimated that the stripping and reclamation maps and data were produced from the ERTS CCTs at a tenth of the cost of conventional techniques.

N74-31797*# Tennessee Univ., Knoxville.
EXTENT OF CYCLIC AND CHANGING ECOLOGICAL PHENOMENA AND SEMIPERMANENT VEGETATION-ECOSYSTEM INTERFACE: ECOLOGICAL APPLICATIONS OF ERTS-A IMAGERY Final Report
H. R. DeSelm, Principal Investigator 5 Aug. 1974 90 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21882)
(E74-10716; NASA-CR-139548) Avail: NTIS HC $7.50 CSCL

08F

There are no author-identified significant results in this report.

N74-31798*# Tennessee Univ., Knoxville. Dept. of Botany.
VEGETATION BOUNDARIES ON ERTS-1 IMAGERY
H. R. DeSelm, Principal Investigator and T. W. Taylor 20 Mar. 1973 10 p refs Presented at the Conf. on Earth Resources Observation and Inform. Anal. System, Tullahoma, Tenn., 26-28 Mar. 1973 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21882)
(E74-10717; NASA-CR-139549) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-31799*# South Dakota State Univ., Brookings. Remote Sensing Inst.
[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Progress Report, Jul. 1974
Victor I. Myers, Principal Investigator 20 Aug. 1974 2 p EREP
(Contract NAS9-13337)
(E74-10718; NASA-CR-139550) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-31800*# Geological Survey, Reston, Va.
CARTOGRAPHIC EVALUATION OF SKYLAB S-192 SCANNER IMAGES Quarterly Progress Report, 1 May - 31 Jul. 1974
John D. McLaurin, Principal Investigator 31 Jul. 1974 3 p EREP
(NASA Order T-4111-B)
(E74-10719; NASA-CR-139551) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-31801*# Geological Survey, Reston, Va.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Mar. - 30 Apr. 1974
Lawrence C. Rowan, Principal Investigator and Pamela H. Wetlaufer 30 May 1974 10 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG-4)
(E74-10720; NASA-CR-139552) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-31802*# Geological Survey, Washington, D.C. Topographic Div.
INVESTIGATION OF ERTS/MSS IMAGERY FOR PHOTOMAPPING OF THE UNITED STATES Progress Report, 1 Jan. 1974 - 28 Feb. 1974
Joseph T. Pilonero, Principal Investigator 1 Mar. 1974 2 p ERTS
(NASA Order S-70243-AG)
(E74-10721; NASA-CR-139554) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. A UTM grid has been fitted to the 1:250,000 scale photomap and has resulted in a RMSE of 50 meters which is well within National Map Accuracy Standards. Fitting of the UTM grid to the State of Arizona photomaps is in progress.

N74-31803*# Geological Survey, Reston, Va. Water Resources Div.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Mar. - 30 Apr. 1974
Edward J. Pluhowski, Principal Investigator 1 May 1974 3 p ERTS
(NASA Order S-70243-AG-2)
(E74-10722; NASA-CR-139555) Avail: NTIS HC $4.00 CSCL 08H

The absence of turbidity plumes during the winter was well documented in an ususually successful sequence of images obtained February 10 - 12, 1974. Useful imagery of the south shore of Lake Ontario was obtained on 3 successive days at a time when sky cover over the area normally approaches complete coverage. Imagery of the Oswego, Genesee, and Niagara rivers failed to detect any plumes, however faint. Despite strong northwest winds on February 11 there was no indication of shoreline erosion generated by wave action. Frozen ground, snow cover, shoreline icing and minimal construction and farm activity without doubt reduces the probability of sediment movement in winter. Thunderstorm activity over the study area is very rare during the cold season so that the erosive energy of rainfall is greatly reduced. Moreover, a fairly high percentage of the winter precipitation is in the form of snow or sleet further reducing the impact of rainfall energy on sediment transport.

N74-31804*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 Mar. 1974 - 30 Apr. 1974
Richard S. Williams, Jr., Principal Investigator 1 May 1974 8 p refs ERTS
(NASA Order S-70243-AG)
(E74-10723; NASA-CR-139556) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Most of the research emphasis was directed at the analysis of Icelandic icecaps on ERTS imagery. A number of new findings were made, including: (1) on low sun angle imagery of Hofsjokull, the outline of a probable central volcano can be seen delineated on the northwest part of the icecap; (2) on low sun angle imagery of Langjokull, two parallel hyaloclastite ridges can be seen to continue for more than 10 km in from the margin of the icecap; (3) measurements of contorted medial moraines on images of Skeioararjokull, acquired about 11 months apart show an approximate 600 m of annual glacier movement; (4) measurements on images of the surging glacier, Eyjabakkajokull, taken about 11 months apart show an approximate 1.8 km of movement during that time; and (5) successive ERTS images of the glacier-dammed lake, Graenalon, show an increase in area of the lake until the ice dam was partially breached, causing a jokulhlaup across the Skeioararsandur. Because of the shape of the lake basin the elevation of the post-jokulhlaup lake can be determined from ERTS imagery to + or - 2 m.

N74-31805*# Bureau of Reclamation, Denver, Colo.
MONITOR WEATHER CONDITIONS FOR CLOUD SEEDING CONTROL Progress Report, 1 Mar. - 30 Apr. 1974
Archie M. Kahan, Principal Investigator 1 May 1974 5 p ERTS
(NASA Order S-70243-AG-8)
(E74-10724; NASA-CR-139557) Avail: NTIS HC $4.00 CSCL 04B

There are no author-identified significant results in this report.

N74-31806*# Geological Survey, Reston, Va. Branch of Eastern Mineral Resources.
THE USE OF ERTS-1 IMAGES IN THE SEARCH FOR LARGE SULFIDE DEPOSITS IN THE CHAGAI DISTRICT, PAKISTAN Final Report, 1 Jan. - 31 Dec. 1973
Robert G. Schmidt, Principal Investigator 1 May 1974 38 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E74-10726; NASA-CR-139572) Avail: NTIS HC $5.00 CSCL 08G

The author has identified the following significant results. Visual examination of color composites was tested under relatively ideal conditions for direct detection of large hydrothermal sulfide

deposits at the low-grade porphyry copper deposit at Saindak, western Chagai District, Pakistan. The Saindak deposit is characterized by an elongate zone of easily eroded sulfide-rich rock surrounded by a resistant rim of hornfels and propylitically altered rock. The geomorphic features related to the Saindak deposit are easily distinguished on ERTS-1 images. Attempts to detect a color anomaly using false-color composites were not successful. About 36,000 square km of the western Chagai District were examined on false-color composites for direct evidence of large sulfide deposits. New geologic information acquired from the images was used in conjunction with the known geology to evaluate two previously known proposed areas and to suggest seven additional targets for field checking, one of which is proposed on the basis of tonal anomaly alone. The study also showed that Saindak-type deposits are not likely to be present in some extensive areas of the Chagai District; and also that a rim like that at Saindak does not form if regional metamorphism has increased the resistance of the country rock to erosion.

N74-31807*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Progress Report, Jul. 1974
George A. Maul, Principal Investigator Jul. 1974 2 p EREP (NASA Order T-4713-B)
(E74-10728; NASA-CR-139574; MPR-13) Avail: NTIS HC $4.00 CSCL 08C

There are no author-identified significant results in this report.

N74-31808*# Environmental Research and Technology, Inc., Lexington, Mass.
EXPERIMENTAL EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENTS USING THE EREP OF SKYLAB Quarterly Progress Report, May - Jul. 1974
David T. Chang, Principal Investigator Jul. 1974 13 p refs EREP
(Contract NAS9-13343)
(E74-10729; NASA-CR-139575; QPR-5) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-31809*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Jul. 1974
Irvin J. Sattinger, Principal Investigator 13 Aug. 1974 2 p EREP
(Contract NAS9-13283)
(E74-10731; NASA-CR-139577; ERIM-103300-31-L) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-31810*# Environmental Research Inst. of Michigan, Ann Arbor.
MAPPING EXPOSED SILICATE ROCK TYPES AND EXPOSED FERRIC AND FERROUS COMPOUNDS FROM A SPACE PLATFORM Quarterly Report, 8 Mar. - 8 Jun. 1974
Robert K. Vincent, Principal Investigator 24 Jun. 1974 26 p refs EREP
(Contract NAS9-13317)
(E74-10732; NASA-CR-139578; ERIM-102000-22-L) Avail: NTIS HC $4.50 CSCL 08B

There are no author-identified significant results in this report.

N74-31811*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
STUDY TO DEFINE POINTS OF ENTRY FOR POTENTIAL CONTAMINANTS IN LIMESTONE AQUIFERS Final Report
F. L. Doyle 21 Nov. 1973 10 p
(Contract NAS8-30216)
(NASA-CR-120322) Avail: NTIS HC $4.00 CSCL 08H

Visual examinations of both prints and transparencies from ERTS 1 and U-2 aircraft imagery provided a method for discovering possible points of entry of potential contaminants into the limestone aquifer in Madison County, Alabama. Knowledge of the locations at which contaminants could enter the aquifer is an important consideration in water quality management, particularly for regions that depend, at least partially, on ground water for their water supply. ERTS 1 imagery recorded on December 28, 1972 in the Multispectral Scanner-5 (MSS-5) and MSS-7 bands, and a false-color composite of the MSS-4 (green), MSS-5 (red), and MSS-7 (near infrared) bands were the principal materials used, along with thermography recorded by an RS-7 infrared scanner onboard a U-2 aircraft. The results of the study are discussed in detail, providing information on prominent lineations and major fracture trends which are related to aquifer contamination. Maps depicting the observations are also presented. A.A.D.

N74-31812# Advisory Group for Aerospace Research and Development, Paris (France).
NONLINEAR EFFECTS IN ELECTROMAGNETIC WAVE PROPAGATION
May 1974 397 p refs Presented at Electromagnetic Wave Propagation Panel Symp., Edinburgh, 12-15 Nov. 1973
(AGARD-CP-138) Avail: NTIS HC $23.00

The excitation of parametric instabilities in the ionosphere and their effects on radio wave propagation are considered. For individual titles, see N74-31813 through N74-31844.

N74-31813 Raytheon Co., Sudbury, Mass.
INTRODUCTORY SURVEY: POTENTIAL APPLICATIONS OF IONOSPHERIC MODIFICATION TO AERONOMY
Gerald Meltz *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 26 p refs (For availability see N74-31812 21-13)

Ionospheric heating by powerful radio waves holds promise for establishing new techniques in the aeronomy of D, E and F-regions. This survey reviews the observed phenomena associated with absorption of HF waves in the context of present theoretical understanding of plasma temperature and density changes, enhanced visible airglow emission and parametric excitation of plasma waves. Cooling rates and electron thermal conductivity are attainable from optical and incoherent scatter measurements of the spatial and temporal changes in electron temperature. Cross modulation experiments or partial reflection techniques could be used to simultaneously measure these changes from which the ambient effective recombination rate and its electron temperature dependence could be inferred. The decay of enhanced airglow yields an estimate of the quenching coefficient and hence the neutral density provided the interaction is a local one. The decay of enhanced plasma waves measures the electron-ion collision frequency at night and the photoelectron flux during the day. Superthermal plasma wave intensities also act as a tracer of density irregularities and plasma drift since parametric pumping acts over a very narrow range of altitudes. Author

N74-31814 Institute for Telecommunication Sciences, Boulder, Colo.
INTRODUCTORY SURVEY: A SURVEY OF IONOSPHERIC MODIFICATION EFFECTS PRODUCED BY HIGH POWER HF RADIO WAVES
William F. Utlaut *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 17 p refs (For availability see N74-31812 21-13)

Experiments with high power, high frequency radio waves have proved the feasibility of temporarily altering the ionosphere's properties. Many different radio and photometric effects have been observed as a result of the ionospheric modification. A survey is given of some of the effects observed near Boulder, Colorado which are produced at times when a 2 MW facility is used to illuminate the overhead ionosphere. Effects to be discussed include artificial generation of spread F, sky mapping of the perturbed ionosphere, wideband attenuation of diagnostic o-mode waves, 6300 A and 5577 A photometric changes and D-region cross modulation phenomena. Author

N74-31815 Rice Univ., Houston, Tex.
PARAMETRIC INSTABILITIES IN THE IONOSPHERE EXCITED BY POWERFUL RADIO WAVES OBSERVED OVER ARECIBO
W. E. Gordon and H. C. Carlson (Arecibo Obs.) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 17 p refs (For availability see N74-31812 21-13)

Enhancements of various features of the incoherent scatter spectrum are observed when the ionosphere is illuminated with powerful, high frequency radio waves. The radio waves excite plasma instabilities producing lines or more complex spectral features near the local plasma frequency, at the local ion-acoustic frequency, near the local gyrofrequency and twice the gyrofrequency. The enhancements occur in a thin slab as observed by the incoherent scatter radar and at both upshifted and downshifted frequencies with respect to the probing radar frequency. The enhancements are observed to vary with time when the high frequency transmitter that produces the radio wave excitation is held at constant power, and to vary with time as the high frequency transmitter is turned on or off. Author

N74-31816* Norges Tekniske Hoegskole, Trondheim.
OBSERVATIONS OF ENHANCED ION LINE FREQUENCY SPECTRUM DURING ARECIBO IONOSPHERIC MODIFICATION EXPERIMENT
T. Hagfors and C. J. Zamlutti *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 13 p refs Sponsored in part by NASA (For availability see N74-31812 21-13)

The Arecibo 430 MHz incoherent scatter radar (ISR) was used to monitor the effects of modifying the ionosphere by a high power HF transmitter feeding the 305 m reflector antenna. When in the ordinary magnetoionic mode parametric instabilities develop in the ionosphere near the reflection level. Manifestations of these instabilities are the strong enhancement of Langmuir oscillations in the direction of the ISR beam at a wavelength of 35 cm and the simultaneous much weaker enhancement of ion oscillations in that direction. The spectral analysis of the enhanced peak with a height resolution of 2.4 km shows that the ionic mode enhancement most often has a double humped frequency spectrum corresponding to up- and down-going ion acoustic waves. The shape of the frequency spectrum is interpreted in terms of a stable oscillation which is driven by a secondary electrostatic field caused by nonlinear interaction of Langmuir waves within a cone centered on the magnetic field and by the scattering of the pump field on stable Langmuir waves travelling along the direction of the ISR. Author

N74-31817 National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
ONSET, GROWTH AND MOTIONS OF IONOSPHERIC DISTURBANCES CAUSED BY HIGH INTENSITY ELECTROMAGNETIC HEATING
J. W. Wright *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 17 p refs (For availability see N74-31812 21-13)

At an observing location 46 km from the Platteville (Colorado) high intensity RF transmitter, multifrequency spaced antenna digitized observations are made of the complex amplitude variations of ionospheric echoes antenna digitized observations are made of the complex amplitude variations of ionospheric echoes of pulsed transmissions by the Kinesonde. Characteristically, all measurable and derivable quantities of the echo signals develop marked changes with altitude dependent delays following E sub P turn-on. Transient phenomena resulting from brief E sub P transmissions are illustrated, as are some ionospheric motions which appear to develop in response to E sub P. Several of the diagnostic techniques demonstrate a desirable high sensitivity to the ionospheric modifications which occurs, but their interpretation is sometime far from straightforward. Author

N74-31818 Stevens Inst. of Tech., Hoboken, N.J.
INTRODUCTORY SURVEY TO SESSION ON PARAMETRIC INSTABILITIES, LABORATORY EXPERIMENTS AND THEORY c07
George Schmidt *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 5 p refs Sponsored in part by AEC (For availability see N74-31812 21-13)

Parametric instabilities produced by electromagnetic waves propagating in a magnetic field free plasma are reviewed. The discussion is based on the use of the ponderamotive force as the basic physical mechanism responsible for these instabilities. If the plasma is bounded the threshold power is non-zero even in the absence of damping, and may be the dominant factor in determining threshold and growth rate values. The threshold for stimulated Raman scattering increases in the presence of plasma density gradients, while temperature gradients have a similar effect on simulated Brillouin scattering. The finite cross section of the pump wave determines the undamped threshold for the filamentation instability. In a nonuniform plasma stimulated Raman backscattering becomes very strong in the neighborhood of the point where the pump frequency is twice the local plasma frequency. Author

N74-31819 Princeton Univ., N.J. Plasma Physics Lab.
LABORATORY EXPERIMENTS ON PARAMETRIC INSTABILITIES AND PLASMA HEATING IN A MAGNETIC FIELD c25
M. Porkolab, V. Arunasalam, and N. C. Luhmann, Jr. *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 16 p refs (For availability see N74-31812 21-13)
(Contract AT(11-1)-3073)

Experimental studies on parametric instabilities and associated plasma heating in a magnetic field are reported. The following parametric decay processes are observed: (1) For pump frequencies omega sub o greater than omega sub a, (where omega sub u is the electron cyclotron frequency) the parametric excitation of Bernstein waves, lower hybrid waves, and ion acoustic waves is observed; (2) for frequencies omega sub o smaller than omega sub ce, omega sub o smaller than omega sub pe externally launched Trivelpiece-Gould modes and whistler-waves have been observed to decay parametrically into electron plasma waves, and ion acoustic waves; (3) for omega sub o approximately omega sub pe, parametric decay into ion acoustic waves and electron plasma waves of the ordinary mode of electromagnetic wave propagation is observed. Fast plasma heating follows the occurance of all the foregoing instabilities. Heating of the main body of plasma particles, as well as tail formation on the distribution function is observed. A comparison between the various regimes is given. Author

N74-31820 TRW Systems Group, Redondo Beach, Calif.
MODELING OF IONOSPHERIC PARAMETRIC INTERACTIONS IN THE QUIPS DEVICE
R. L. Stenzel, A. Y. Wong, D. Arnush, B. D. Fried, and C. F. Kennel *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 18 p refs (For availability see N74-31812 21-13)
(Contract F30602-72-C-0304)

A large quiescent steady state plasma device has been constructed for experiments on parametric mode coupling instabilities produced by an S-band electromagnetic pump matched to the local plasma frequency in a weak, controllable plasma density gradient. One purpose of this experiment is to study the linear instabilities, and their nonlinear saturation, produced by HF excitation irradiation of the F-region. In that vicinity linear conversion from the incident electromagnetic waves (EMW) to electrostatic waves (ESW) at pump frequency is observed. When the pump intensity exceeds a certain threshold lower frequency ESW and ion acoustic waves are parametrically generated which are polarized along the density gradient and which, within measurement accuracy, satisfy frequency and wave vector matching conditions. Amplification by the pump of launched ion acoustic waves along with the simultaneous appearance of a parametrically matched ESW has been observed. Inserting two pump frequencies, separated by the ion acoustic frequency, has been observed to create double resonance excitation. The relevance of these to ionospheric observations are discussed. Author

N74-31821 National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
MODIFIED ELECTRON DISTRIBUTION FUNCTION DURING PARAMETRIC INSTABILITIES c24
Jerome Weinstock and Bandel Bezzerides *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 6 p

refs (For availability see N74-31812 21-13)
A calculation is made of the heating of electrons by parametrically excited Langmuir wave turbulence in a homogeneous plasma. The number of hot electrons is determined by a kinetic equation in which the effects of turbulence are described by a stochastic wave diffusion tensor. Both resonant and resonant broadened wave-particle interactions, as well as the angular distribution of Langmuir waves, are important. The kinetic equation is solved for a steady state by balancing the turbulent diffusion with a relaxation collision term. It is predicted that suprathermal electrons exist to velocities as large as the fastest growing phase velocity. Author

N74-31822* Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
THE SATURATION SPECTRUM OF PARAMETRIC INSTABILITIES
J. A. Fejer and Yu-Yun Kuo (Calif. Univ., La Jolla) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 10p (For availability see N74-31812 21-13)
(Grants NGR-05-009-076; NSF GA-30628)

Recent calculations on the nonlinear saturation spectrum of the parametric decay instability are described. The initial calculations did not use the correct expression for the spontaneous emission term and were aimed at obtaining the distribution of spectral energy in the unstable part of wave vector space. Results of those initial calculations are combined here with the correct expression for the spontaneous emission term to obtain the distribution of spectral energy in the stable part of wave vector space. These latter calculations are believed to be relevant to the interpretation of the so called plasma line spectra obtained in ionospheric heating experiments at Arecibo, Puerto Rico. Author

N74-31823 TRW Systems Group, Redondo Beach, Calif.
THEORY OF DOUBLE RESONANCE PARAMETRIC EXCITATION IN THE IONOSPHERE
D. Arnush (Hiroshima Univ.), K. Nishikawa, B. D. Fried, C. F. Kennel, and A. Y. Wong *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 7 p refs (For availability see N74-31812 21-13)
(Contracts AT(04-3)-34; F44620-73-C-0007)

Reviewed is a general theory of the parametric instabilities in a plasma driven by a long wavelength electric field with two pump frequencies which lie near the resonant frequency for Langmuir oscillations. A general dispersion relation in terms of linear susceptibilities, is derived by retaining, on a selective basis, terms of fourth order in the pump amplitudes. Illustrative calculations, appropriate to the ionosphere, are carried out using resonant approximations. A lowering of the net power threshold for instability is found in both cases for E-layer parameters, i.e., when the linear damping rate of the electronic wave is large compared to omega. In addition, in both the E- and F-layers, a coupling between the decay and oscillating two stream instabilities occurs when delta is approximately equal to omega. It is suggested that since the oscillating two stream is an absolute instability which is ordinarily not generated because of its high threshold, double resonance stimulation of this mode may enhance saturated wave amplitudes. Author

N74-31824* Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
GENERATION OF LARGE SCALE FIELD-ALIGNED DENSITY IRREGULARITIES IN IONOSPHERIC HEATING EXPERIMENTS
J. A. Fejer *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 7 p refs (For availability see N74-31812 21-13)
(Grant NGR-05-009-076; Contract DAHC04-72-C-0037; Grant NSF GA-30628)

Threshold and growth rate for stimulated Brillouin scattering are calculated for a uniform magnetoplasma. These are then compared with the threshold and growth rate of a new thermal instability in which the nonlinear Lorentz force felt by the electrons at the beat frequency of the two electromagnetic waves is replaced by a pressure force due to differential heating in the interference pattern of the pump wave and the generated electromagnetic wave. This thermal instability, which is still essentially stimulated Brillouin scattering, has a threshold which is especially low when the propagation vector of the beat wave is almost normal to the magnetic field. The threshold is then considerably lower than the threshold for normal stimulated Brillouin scattering and therefore this new instability is probably responsible for the generation of large scale field aligned irregularities and ionospheric spread F. Author

N74-31825 Bell Telephone Labs., Inc., Murray Hill, N.J.
INSTABILITIES AND NONLINEAR PROCESSES IN GEOPHYSICS AND ASTROPHYSICS
Akira Hasegawa *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 13 p refs (For availability see N74-31812 21-13)

A review of plasma instablilities and some of their nonlinear effects on geophysical and astrophysical plasmas is presented. The nonlinear effects cover: (1) quasilinear diffusion; (2) anomalous resistivity; (3) wave-wave, wave-particle interactions; and (4) modulational instability and formation of wave packet. Author

N74-31826 TRW Systems Group, Redondo Beach, Calif.
TYPE 1 IRREGULARITIES IN THE AURORAL AND EQUATORIAL ELECTROJETS
C. F. Kennel and D. Arnush *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 24 p refs (For availability see N74-31812 21-13)
(Contract N00014-69-A-0200-4050)

Theoretical knowledge concerning irregularities in the equatorial and auroral electrojets is considered with particular emphasis upon Type I irregularities. A simple model of equatorial electrojet polarization is reported. The evidence that discrete auroral arc electrojets flow at the poleward edge of the auroral oval and a diffuse electrojet at the equatorward edge is discussed. A simple model of the diffuse electrojet is formulated, and the linear theory of electrojet instabilities is reviewed. A new fluid theory dispersion relation for the two-stream instability, valid even at the Pedersen conduction maximum is presented, despite drastic differences in electrojet geometry, the similarities between the Doppler spectra, particularly for Type I irregularities, suggest that the nonlinear saturation mechanisms are similar in both electrojets. Author

N74-31827 Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasma Physik.
NONLINEAR THEORY OF INSTABILITIES IN THE EQUATORIAL ELECTROJET
Andre Rogister *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 13 p refs (For availability see N74-31812 21-13)

It is suggested that the stabilization of Type I irregularities has two aspects: In a first step the turbulence inhibits the formation of large currents and maintains the plasma in a state relatively close to marginal stability; In a second step, energy is transfered by two-dimensional nonlinear wave coupling processes from the linearly growing modes propagating mainly in the direction of the electron drift velocity to linearly damped ones propagating in other directions. This transfer process open the aperture of the cone containing the directions of propagation of suprathermal waves. It is also suggested that stabilization of Type II irregularities mainly occurs via one-dimensional wave-wave scattering processes which transfer the energy from large wave-lengths, where it is generated, to small wavelengths, where it is absorbed by diffusion; the process extends toward larger wavenumbers the spectrum of suprathermal waves. Most of the observed features of Type I and Type II irregularities can be explained by these theories. Author

N74-31828 Oxford Univ. (England). Dept. of Theoretical Physics.
PLASMA MECHANISMS FOR PULSAR EMISSION c25
J. W. Buckee, S. Grounds, L. C. M. Miranda, and D. TerHaar *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 8 p refs (For availability see N74-31812 21-13)

A partial analysis is presented of the nonlinear processes occurring in a strongly magnetized plasma through which a beam of relativistic particles is passing. The conversion of longitudinal plasmons into transverse waves through Compton scattering is considered and it is found that the frequency of these waves

lies close to the plasma frequency which lies in the radio band for the plasma. Radio waves beamed at right angles to the magnetic field are linearly polarized. These characteristics can be shown to be conserved in the propagation of the transverse waves through the magnetosphere and are in good agreement with observational pulsar data. The processes considered can produce the observed large radio brightness of pulsars. Author

N74-31829 King's Coll., London (England). Dept. of Mathematics.
A SELF CONSISTENT THEORY OF TRIGGERED VLF EMISSIONS **c07**
D. Nunn and M. J. Rycroft (Southampton Univ., England) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 15 p refs (For availability see N74-31812 21-13)

The nonlinear interaction of cyclotron resonant electrons with VLF radio waves is used to explain the phenomenon of VLF emissions triggered by whistler mode signals propagating in the earth's magnetosphere. It is found that in an inhomogeneous medium resonant particles become stably trapped in the wave and make a dominant contribution to the nonlinear resonant particle current. This current continuously modifies the wave field and effectively causes the emission. This simplifying feature makes possible a fully self consistent simulation of the triggering process. The computer model described in this paper successfully produces rising and falling tones similar to those observed experimentally. Sideband stability and the origin of spectral structuring in banded chorus are also discussed. Author

N74-31830 Comissao de Etudos da Energia Nuclear, Lisbon (Portugal). Inst. Superior Tecnico.
WHISTLER TRIGGERED EMISSIONS **c07**
A. L. Brinca *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 11 p refs (For availability see N74-31812 21-13)

The electromagnetic radiation from energetic particles evolving in the geomagnetic mirror is used to describe the main phase of emissions artificially stimulated by signals propagating in the whistler mode. Those particles are in a cyclotron resonance with the triggering whistler of arbitrary obliquity in the vicinity of the equator (onset region); their velocity distribution becomes unstable to the whistler mode through the nonlinear evolution of the wave-particle interaction. The obtained spectral shapes reproduce most of the forms observed in triggered emissions of short duration. Author

N74-31831 Newcastle-upon-Tyne Univ. (England). Dept. of Engineering Mathematics.
NONLINEAR WAVE MODULATION OF WHISTLER WAVES **c07**
Masayoshi Tajiri *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 11 p refs (For availability see N74-31812 21-13)

Nonlinear modulation of the electromagnetic waves propagating parallel to a magnetic field is investigated by means of a modification of the reductive perturbation method developed by Taniuti and Yajima. The Vlasov equation is reduced to a modified nonlinear Schrodinger equation which includes additional nonlinear terms. It is conjectured that these terms arise from the weak but continuous resonant action that takes place between the wave and particle velocity. Author

N74-31832 Istituto Nazionale di Geofisica, Rome (Italy). Ionospheric Dept.
NONLINEAR MAGNETOIONIC EFFECTS IN THE MAGNETOGUIDING OF WHISTLERS **c07**
P. Dominici *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 3 p refs (For availability see N74-31812 21-13)

The complete basic equations of the magnetoionic theory in the Q.L. approximation are examined in order to explain the magnetoguided propagation of whistlers; the principal result is briefly discussed, namely the existence of nonlinear terms of current, related to self trapping magnetoionic components both in lower and upper ionosphere. Author

N74-31833 Norwegian Inst. for Air Research, Kjeller.
INTRODUCTORY SURVEY: NONLINEAR EFFECTS IN PLASMA RESONANCES AND ION SHEATH **c25**
Kristen Folkstad *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 8 p refs (For availability see N74-31812 21-13)

Some nonlinear properties observed in ionospheric topside soundings are considered and particle generated emissions in the near space environment are discussed. The energy transfer which takes place between interacting waves in a plasma is determined by their phase relationship. Criteria for distinguishing between the cases of strong and weak coupling in three wave interactions are described. A useful quantum mechanical analogy pertaining to weakly interacting random waves is mentioned. The possible role of the ion sheath as a source for nonlinear signal generation is evaluated. Author

N74-31834 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
NARROWBAND RADIO NOISE IN THE TOPSIDE IONOSPHERE **c07**
H. G. James, E. L. Hagg, and D. L. P. Strange *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 18 p refs (For availability see N74-31812 21-13)

Strong narrow bands of radio noise at frequencies near 2 and 4 MHz are occasionally observed by the ISIS satellites at auroral latitudes. A characteristic smooth peak in amplitude is often observed at the upper frequency limit of the lower frequency noise band. A self consistent interpretation for this part of the spectrum is proposed involving waves propagating upward from below the spacecraft. Ray tracing has been applied to the spatial geometry of the noise region to find the point source height for that part of the spectrum exhibiting the smooth peak. This source is located at altitude where the upper hybrid frequency, f sub T equals twice the electron gyrofrequency, 2 f sub H. Furthermore the observed peak frequency, f, satisfies the relation f = f sub T = 2f sub H. The condition f sub T = 2f sub H is important because, according to the hot-plasma wave dispersion theoryit defines an ionospheric height above which electrostatic-to-electromagnetic-o-mode wave conversion is more probable than below it. There is some evidence that the noise band near 4 MHz originates from the same source is the smooth peak component. Author

N74-31835 Norwegian Inst. for Air Research, Kjeller.
RESONANCE PHENOMENA OBSERVED ON MOTHER-DAUGHTER ROCKET FLIGHTS IN THE AURORAL IONOSPHERE **c07**
K. Folkestad and J. Troim *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 15 p refs (For availability see N74-31812 21-13)

Swept frequency transmissions in the HF band on mother/daughter rocket flights have revealed certain resonance frequencies where the transmitted stimulus evidently excites nonlinear mechanisms somewhere along the propagation path. The nonlinear effects are disclosed by notable signals being detected in receivers whose pass bands differ from the frequencies of the generating signals. It appears that major experimental features may be explained in terms of the theory of resonance cones in an anisotropic propagation medium. For the plasma parameters of the lower ionosphere such resonances may exist in the lower branch for frequencies below the electron gyrofrequency, and in the upper branch for frequencies between the plasma frequency and the upper hybrid frequency. Graphs of the admittance measured at the terminal of the transmitting antenna show a very pronounced dependence upon the level of the driving voltage. Author

N74-31836 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
MODIFICATION OF THE PLASMA IMPEDANCE OF AN ANTENNA DUE TO ION SHEATH INDUCED NONLINEARITIES **c25**
H. Thiemann, R. Kist, E. Neske, and K. Rebstock *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 9 p refs (For availability see N74-31812 21-13)

Measurements with a cylindrical sensor in a laboratory plasma applying large RF voltages showed specific modification of the impedance around series resonance. The purpose of the work presented here is to understand this modification in terms of

sheath induced nonlinearities. A nonlinear differential equation derived from a network representing the sheath-plasma-system has been solved numerically in a general way. A corresponding computer program determined the voltage drop across the ion sheath, the Fourier Spectrum of the RF current through the system and its resulting impedance. Numerical results show that scattering of RF energy into higher harmonics of the frequency applied is not important around series resonance. The measured impedance modification when varying the RF voltage can be understood using the concept of an effective sheath resistor, defined by integration of the differential resistor of the sheath's current-voltage characteristic over one period of the voltage drop across the sheath. Author

N74-31837 SIGMA Association, Hamburg (West Germany).
RESONANCE FREQUENCY OF AN IONIZED LAYER IN DEPENDENCE ON LAYER THICKNESS **c07**
C. Fengler *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 6 p refs (For availability see N74-31812 21-13)

An ionized symmetric layer gets excited by an electromagnetic pulse. The evaluation of the pulse response yields a resonance frequency in dependence on layer thickness. The oscillation occurs above a minimum thickness of the layer only. At large layer thickness the frequency of oscillation asymptotically approaches the plasma frequency. Author

N74-31838 Office of Naval Research, London (England).
INTRODUCTORY SURVEY: WAVE INTERACTION IN THE LOWER IONOSPHERE: A SURVEY
A. H. Waynick *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 8 p refs (For availability see N74-31812 21-13)

A summarization of the reviews to date on the field of wave interaction in the lower ionosphere is attempted. This covers the study of the interaction process and the determination of electron density, electron-neutral collisional frequency, and height distribution in D-region. The current status of the use of this technique in synoptic profile procurement and the role of this work in investigations on the physics and chemistry of this region are outlined. Author

N74-31839 New England Univ., Armidale (Australia).
ELECTRON HEATING IN THE IONOSPHERE BY POWERFUL GYRO-WAVES **c24**
R. A. Smith and R. G. Loch (Warrnambool Inst. of Advanced Education, Victoria, Australia) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 14 p refs (For availability see N74-31812 21-13)

Pulse wave interaction experiments using disturbing gyro-waves radiated by an aerial array of 40 dipoles are described. Steady state and transient changes in the amplitudes and phases of 1.78 and 2.12 MHz wanted pulses have been measured for transmitted powers at the gyro-frequency (1.515 MHz) in the range 0.7 - 500 kW. The wave interaction effects have been computed using a model of the behavior of slow electrons in air which links properties for the thermal energy known from ionospheric wave interaction experiments to properties for energies well above the thermal known from laboratory experiments. Excellent agreement with the experimentally measured amplitude and phase changes is obtained over the entire power range. The effects of night-to-night variability of the lower E region on the temperature rise and the factors which limit it, are discussed. Author

N74-31840 Pennsylvania State Univ., University Park. Ionosphere Research Lab.
WAVE INTERACTION USING A PARTIALLY REFLECTED PROBING WAVE **c07**
W. A. Kissick and A. J. Ferraro *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 9 p refs (For availability see N74-31812 21-13)
(Contract N00014-67-A-0385-0014; Grant NSF GA-13885)

A proposed new form for the wave interaction experiment is reported which utilizes a partially reflected echo of the probing wave that originates in the heated region. Digital computer simulation shows that the amplitude interaction coefficient can be as high as 0.1 for certain conditions. The effects of self-heating are calculated by using the probing wave parameters and geometry. A significant change in the measured A sub x/A sub o ratio occurs when the self-heating effect is included. Author

N74-31841 Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
DOUBLE CROSS MODULATION IN THE D-REGION
G. C. Rumi *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 15 p refs (For availability see N74-31812 21-13)
(Grant NSF GP-5452)

An experiment of cross modulation in the lower D-region that made use of 2 relatively high frequencies is described. Its peculiarity was that the received wanted wave - on account of its relatively high frequency - contained a relatively strong extraordinary component together with the ordinary component. Such an echo was received alternatively by means of circularly and linearly polarized antennas, so that both amplitude cross modulation and cross modulation of the plane of polarization were detected. The discrimination between these two kinds of cross modulation was obtained just by shifting from one kind of antenna to the other. Since the experiment produced two pieces of information analytically related to the two knowns of the ionosphere at a specific height, namely the electron density, and its collision frequency, both of them were determined for heights ranging between 70 and 40 km. Author

N74-31842 Leicester Univ. (England). Dept. of Physics.
MODIFICATION EFFECTS IN THE IONOSPHERIC D-REGION
Tudor B. Jones *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 6 p refs (For availability see N74-31812 21-13)

Nonlinear effects are observed during D region heating experiments using the high power transmitter at Platteville, Colorado. The first experiments, in which the power and frequency of the modifying transmitter were varied, indicate that the electron temperature changes are greater than perturbation magnitude. Experimental results are in good agreement with cooling due to the excitation of the rotational bands of molecular nitrogen. Later experiments, in which two frequencies are transmitted simultaneously, indicate that nonlinear frequency mixing may occur when the frequency difference is equal to the gyro-frequency. Author

N74-31843 Camerino Univ. (Italy).
NUMERICAL SOLUTION OF A PROBLEM OF NONLINEAR WAVE PROPAGATION THROUGH PLASMAS **c07**
L. M. DeSocio and G. Gaffuri *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 10 p refs (For availability see N74-31812 21-13)

The self-interaction of an electromagnetic wave propagating through a plasma layer has been considered as a typical example of nonlinear effect in the ionosphere. For the plasma, the indicative values of the physical characteristics of the D region have been considered. Quasi-longitudinal and non derivative propagation have been assumed and the electron heating is supposed to be described by Bailey's equation. The problem of determining the changes of the modulation index, the second harmonic distortion and the total absorption of both the ordinary and extraordinary waves has been solved numerically in an extensive range of values of the characteristic parameters. Author

N74-31844 Naples Univ. (Italy). Centro Studi di Radiopropagazione.
THE IONOSPHERIC PROPAGATION OF THE MODULATED WAVES WITH CARRIER FREQUENCIES FAR FROM AND VARYING AROUND THE GYROFREQUENCY **c07**
M. Cutolo, P. DiMaio, G. Gaffuri, G. Agnelli (Osservatorio Astronomico di Rome, Italy), F. Fabbri (Osservatorio Astronomico di Rome, Italy), M. Iannello (Osservatorio Astronomico di Rome, Italy), R. Flagg (Florida Univ.), and W. Greenman (Florida Univ.) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 13 p refs (For availability see N74-31812 21-13)

The self modulation phenomenon has been studied with oblique and with vertical incidence and with C.W. and pulse techniques. The C.W. experiments to demonstrated that the phenomenon clearly depends on the power emitted by the radio

transmitting station. While the transmissions with C.W. were made with a carrier frequency far from the local gyrofrequency, the pulse transmissions were made with a carrier frequency varying around the gyrofrequency. The experiments have shown that it is possible ta have demodulation or overmodulation and a resonance curve when the carrier frequency varies around the local gyrofrequency. The experiments made during the total solar eclipse of 7th March 1970 are also discussed. Author

N74-31845# Joint Publications Research Service, Arlington, Va.
EFFECT OF UNDERGROUND EXPLOSIONS AND CHANGES IN PROPERTIES OF A MEDIUM IN A SEISMICALLY ACTIVE REGION
29 Jul. 1974 17 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 215, no. 5, 1974 p 1097-1104
(JPRS-62595) Avail: NTIS HC $4.00

Articles are presented on the seismic action of underground explosions, and the rapid changes of electrical and seismic properties on the electric fields of Kamchatka. For individual titles, see N74-31846 through N74-31847.

N74-31846 Joint Publications Research Service, Arlington, Va.
SEISMIC ACTION OF UNDERGROUND EXPLOSIONS
M. A. Sadovskiy and V. N. Kostyuchenko *In its* Effect of Underground Explosions and Changes in Properties of a Medium in a Seismically Active Region (JPRS-62595) 29 Jul. 1974 p 1-7 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 215, no. 5, 1974 p 1097-1100 (For availability see N74-31845 21-13)

The extent of damage to buildings by seismic waves from underground blasts was investigated. The correlation between the frequency of damage and the rate of soil displacement during seismic influence was found to be high, and by considering a critical velocity value, below which the likelihood of damage is slight, the normal distributions of damaged buildings are determined. F.O.S.

N74-31847 Joint Publications Research Service, Arlington, Va.
RAPID CHANGES OF ELECTRICAL AND SEISMIC PROPERTIES OF A MEDIUM IN A SEISMICALLY ACTIVE REGION
G. A. Sobolev and L. B. Slavina *In its* Effect of Underground Explosions and Changes in Properties of a Medium in a Seismically Active Region (JPRS-62595) 29 Jul. 1974 p 8-14 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 215, no. 5, 1974 p 1101-1104 (For availability see N74-31845 21-13)

The results of observations for two different geophysical fields are compared using a standardized procedure for their machine processing. Algorithms were developed for processing the variations in the electrotelluric field on Kamchatka. The algorithms include a calculation of differences between the current velocity ratio, and the average value for a given station. F.O.S.

N74-31848# Environmental Data Service, Washington, D.C.
INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 2 Progress Report, Jul. 1972 - Apr. 1973
Sep. 1973 70 p refs Sponsored by NSF
Avail: NTIS HC $6.50

Long term integrated research in marine pollution and geochemical processes are presented. It is shown that this international cooperative program applies geochemical and hydrographic measurements to the study of circulation and mixing processes, in the world oceans. Also included are quantitative studies of oceanic mixing, to serve as a baseline for the concentration levels of metals and products in the deep sea. M.C.F.

N74-31849*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN TIDES AND QUASI-STATIONARY DEPARTURES FROM THE MARINE GEOID INVESTIGATION
J. W. Siry, W. D. Kahn, J. W. Bryan, and F. O. Vonbun Jan. 1973 25 p refs
(NASA-TM-X-70717; X-590-73-248) Avail: NTIS HC $4.25 CSCL 08C

The detection of tides and/or currents through the analysis of data generated in connection with the Ocean Geoid Determination Investigation is presented. A discussion of the detailed objectives and approach are included. M.C.F.

N74-31850*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A COMPARISON OF THE STRUCTURE AND FLOW CHARACTERISTICS OF THE UPPER TROPOSPHERE AND STRATOSPHERE OF THE NORTHERN AND SOUTHERN HEMISPHERES
Robert F. Adler Apr. 1974 160 p refs
(Grant NGR-06-002-098; Contract AT(11-1)-1340)
(NASA-CR-139600; Paper-216) Avail: NTIS HC $11.00 CSCL 04A

The general circulations of the Northern and Southern Hemispheres are compared with regard to the upper troposphere and stratosphere using atmospheric structure obtained from satellite, multi-channel radiance data. Specifically, the data are from the Satellite Infrared Spectrometer (SIRS) instrument aboard the Nimbus 3 spacecraft. The inter-hemispheric comparisons are based on two months of data (one summer month and one winter month) in each hemisphere. Topics studied include: mean meridional circulation in the Southern Hemisphere stratosphere; magnitude and distribution of tropospheric eddy heat flux; magnitudes of energy cycle components; and the relation of vortex structure to the breakdown climatology of the Antarctic stratospheric polar vortex. Author

N74-31851# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, SEPTEMBER 1973
1974 344 p refs
Avail: NTIS HC $20.25

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N74-31852# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, OCTOBER 1973
1974 311 p refs
Avail: NTIS HC $18.75
For abstract, see N74-31851.

N74-31853# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, NOVEMBER 1973
1974 308 p refs
Avail: NTIS HC $18.50
For abstract, see N74-31851.

N74-31854# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, DECEMBER 1973
1974 310 p refs
Avail: NTIS HC $18.50
For abstract, see N74-31851.

N74-31855*# Old Dominion Univ., Norfolk, Va. Dept. of Biology.
THE USE OF COLOR INFRARED AERIAL PHOTOGRAPHY IN DETERMINING SALT MARSH VEGETATION AND DELIMITING MAN-MADE STRUCTURES OF LYNNHAVEN BAY, VIRGINIA M.S. Thesis
Robert E. Holman, III Jun. 1974 51 p refs
(Grant NGL-47-003-067)
(NASA-CR-62099) Avail: NTIS HC $5.75 CSCL 08H

Color infrared aerial photography was found to be superior to color aerial photography in an ecological study of Lynnhaven Bay, Virginia. The research was divided into three phases: (1) Determination of the feasibility of correlating color infrared aerial photography with saline wetland species composition and zonation patterns, (2) determination of the accuracy of the aerial interpretation and problems related to the aerial method used; and (3) comparison of developed with undeveloped areas along Lynnhaven Bay's shoreline. Wetland species composition and plant community zonation bands were compared with aerial infrared photography and resulted in a high degree of correlation. Problems existed with changing physical conditions; time of day, aircraft angle and sun angle, making it necessary to use several

different characteristics in wetland species identification. The main characteristics used were known zonation patterns, textural signatures and color tones. Lynnhaven Bay's shoreline was 61.5 percent developed. Author

N74-31856# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
OBSERVED LONG-PERIOD FLUCTUATIONS IN 500-mb HEIGHTS: SUPPLEMENTARY TEXT TO NCAR FILMS J-4 AND J-6
Roy L. Jenne, John M. Wallace (Washington Univ.), John A. Young (Wisconsin Univ.), and Eric B. Kraus (Miami Univ.) Jan. 1974 71 p refs
(NCAR-TN/STR-94) Avail: NTIS HC $6.75

Two motion picture films were produced to show the longer period variations in the 500 mb height fields for the Northern Hemisphere. The two films are called Daily 500-mb Heights and Long-Period Fluctuations' and 'Long-Period Fluctuations in 500-mb Heights'. The text was prepared as an aid in the use of these films. The films were made by using the computer facilities at the National Center for Atmospheric Research.
Author

N74-31857# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
A SELECTED CLIMATOLOGY OF THE SOUTHERN HEMISPHERE: COMPUTER METHODS AND DATA AVAILABILITY
Roy L. Jenne, Harold L. Crutcher, Harry VanLoon, and J. J. Taljaard Jan. 1974 95 p refs
(NCAR-TN/STR-92) Avail: NTIS HC $7.75

The computer methods used for the processing of climatological data are described, and the availability of a tape with magnetic grid point information for the Southern Hemisphere is announced. A set of microfilm having approximately 10,000 frames of basic charts, seasonal changes, cross section, and grid point values is also described. A computer produced motion picture concerning the climatology of the Southern Hemisphere is discussed.
Author

N74-31858# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN: DEW (FROST)-POINT TEMPERATURE, ATMOSPHERIC ELECTRICITY, LONG WAVE RADIATION, ATMOSPHERIC OZONE 1971 - 1972
1974 373 p refs
Avail: NTIS HC $21.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data rocketsonde data.
Author

N74-31859# Ionospharen-Institut Breisach (West Germany).
ABSORPTIONS DATA: FREIBURG, URSI-CODE 131, JANUARY - MARCH 1973 [ABSORPTIONS-DATEN: FREIBURG, URSI-CODE 131, JANUAR - MAERZ 1973]
E. Harnischmacher Mar. 1973 70 p
Avail: NTIS HC $6.50

Ionospheric absorption data, obtained using echo amplitude measurements made with the digisonde instrument, are presented in tabular form. The digisonde reproduces echo traces by their amplitudes, and prints out readings in the form of digitalized ionograms in the frequency range of 1.0 MHz to 16.0 MHz for the E and F regions. A.A.D.

N74-31860*# Scientific Translation Service, Santa Barbara, Calif.
QUALITATIVE AND QUANTITATIVE EVALUATION OF AN ERTS IMAGE (NASA 1005-13335). AREA: HUANCHACA, SANTA CRUZ COUNTY, EASTERN BOLIVIA
L. J. Pareja Washington NASA Aug. 1974 10 p Transl. into ENGLISH of "Evaluacion Cualitativa y Quantitativa de una Imagen ERTS (NASA 1005-13335). Area: Huanchaca, Departamento Santa Cruz, Oriente de Bolivia" Original contains color illustrations
(Contract NASw-2483)
(NASA-TT-F-15858) Avail: NTIS HC $4.00 CSCL 08B

Qualitative and quantitative evaluations of ERTS satellite images of an area in eastern Bolivia have been made by the Bolivian Geological Service. The main objective of the photointerpretation analysis was to assess the information to be obtained from a diazo false color composition obtained from the conjunction of three images in the MSS bands 4, 5, and 7, reproduced in the primary colors known in the color film as cyan, magenta, and yellow. Author

N74-31861*# South Dakota State Univ., Brookings. Remote Sensing Institute.
REMOTE SENSING FOR EVALUATING POST-DISASTER DAMAGE CONDITIONS: THE PIERRE, SOUTH DAKOTA TORNADO, 23 JULY 1973
Alvin E. Rusche and Victor I. Myers Aug. 1974 15 p refs (Grant NGL-42-003-007)
(NASA-CR-13962; SDSV-RSI-74-2) Avail: NTIS HC $4.00 CSCL 02C

Remote sensing data obtained from aerial reconnaissance of tornado damage to the city of Pierre, South Dakota on July 23, 1973 was evaluated to determine its value as a decision making and management tool in post-disaster restoration activities. The imaging techniques used are briefly discussed, and both aerial and closeup color photographs are provided which were used in the evaluation. The immediate advantages of the data are identified as a 'quick-look' assessment, and a list is given which outlines the additional advantages for which positive rescue and cleanup action may be initiated. Hail and flood damage evaluation, and remote sensing of crop damage due to insect of disease infestation is also briefly described. A.A.D.

N74-31862# Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE SERVICE FOR GEOMAGNETISM AND AERONOMY FOR 1972 [ANUARIOS DEL SERVICIO DE GEOMAGNETISMO Y AERONOMIA]
1972 192 p In SPANISH
Avail: NTIS HC $12.75

The results are presented of continuous systematic measurements of the components of the terrestrial magnetic field. Charts of the daily variations in the components are included along with tables of the magnetic activity indices K + C. Sudden changes in the magnetic field are reported, and classified according to the phenomenon indicated by the magnetogram.
Transl. by F.O.S.

N74-31863# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
DIRECTORY OF STATE AGENCIES ENGAGED IN ENVIRONMENTAL MONITORING
Dec. 1973 88 p
Avail: NTIS HC $7.50

A catalogue of the professional personnel at the state level who are responsible for environmental control and monitoring programs in the areas of air and water quality, water supply, solid waste management, pesticides, radiation, and noise is presented. The listings, which are made by state, include the name of the state health officer and other program heads with pertinent addresses, telephone numbers, and office hours.
Author

N74-31864*# Illinois Univ., Urbana. Aeronomy Lab.
DIGITAL IONOSONDE STUDIES OF F-REGION WAVES
R. M. Harper and S. A. Bowhill 1 Jul. 1974 141 p refs (Grant NGR-14-005-181)
(NASA-CR-139652; Aeronomy-60; UILU-Eng-74-2503) Avail: NTIS HC $10.25 CSCL 04A

Accurate fixed-frequency virtual height data collected on a digital ionosonde are analyzed to measure speed and direction of traveling ionospheric disturbances by matching the experimental data with virtual height and echo amplitude obtained from a simple model of the disturbed ionosphere. Several data records analyzed in this manner indicate speeds of 400 to 680 m/sec and a direction of propagation from north to south. The digital ionosonde collects virtual height data with a time resolution of 10 sec and a height resolution of less than 300 m. Author

N74-31865*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
OZONE MEASUREMENT SYSTEMS IMPROVEMENTS STUDIES

Robert W. Thomas, Keith Guard, Alfred C. Holland, and John F. Spurling Washington Aug. 1974 97 p refs Prepared in part by Wolf Research and Development Corp., Riverdale, Md. (Contract NAS6-2173)
(NASA-TN-D-7758) Avail: NTIS HC $4.00 CSCL 04A

Results are summarized of an initial study of techniques for measuring atmospheric ozone, carried out as the first phase of a program to improve ozone measurement techniques. The study concentrated on two measurement systems, the electro chemical cell (ECC) ozonesonde and the Dobson ozone spectrophotometer, and consisted of two tasks. The first task consisted of error modeling and system error analysis of the two measurement systems. Under the second task a Monte-Carlo model of the Dobson ozone measurement technique was developed and programmed for computer operation. Author

N74-31866# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
HALL EFFECT MAGNETOMETER: A PRELIMINARY STUDY [MAGNETOMETRE A EFFET HALL: ETUDE PRELIMINAIRE]
J. F. Karczewski and J. M. Moreau Jan. 1974 40 p refs In FRENCH
(GRI/NTP/124) Avail: NTIS HC $5.00

Design technology, theories, and principle functions of the Hall effect magnometer are discussed. Data are given on flux reaction, direct amplification with gain, and magnetic and electronic characteristics. Transl. by E.H.W.

N74-31867# South Dakota State Univ., Brookings. Remote Sensing Inst.
EVALUATION OF ERTS-1 IMAGERY FOR USE ON THE PINE RIDGE RESERVATION
C. J. Frazee, R. L. Carey, and J. L. Gropper Nov. 1973 33 p refs Sponsored by Bur. of Indian Affairs Original contains color illustrations
(SDSU-RSI-73-10) Avail: NTIS HC $4.75 CSCL 08B

Agricultural conservation features were identified and general resource areas delineated using ERTS-1 satellite imagery on the Pine Ridge Indian Reservation in southwestern South Dakota. Photo interpretation techniques were used to analyze ERTS-1 imagery taken on August 19, 1972, and May 17, 1973. Utilizing the August 1972 imagery, general soil areas were delineated using photo characteristics, such as drainage patterns, drainage densities, tone, land use patterns, and color. The existing standard soil survey was used to determine the range sites and land capability subclasses comprising the delineated units. Each of the photo-mapped units interpreted from the ERTS-1 imagery had a unique range site and land capability subclass composition. Therefore, the photo interpreted units delineated on the ERTS-1 imagery were general soil resource areas. Author

N74-31868# Office of Water Resources Research, Washington, D.C.
COOPERATIVE WATER RESOURCES RESEARCH AND TRAINING Annual Report, 1973
1973 286 p refs
Avail: NTIS HC $17.50 CSCL 08H

Research activities reported range from the development of a computer program to determine reservoir release, analyses of thermal discharge and sediment pollution effects on water quality and ecologic simulation of aquatic environments, to economic water harvesting systems featuring management of precipitation and water storage. G.G.

N74-31869# Scientific Translation Service, Santa Barbara, Calif.
MAXIMUM PERMISSIBLE CONCENTRATIONS OF HARMFUL SUBSTANCES IN THE ATMOSPHERIC AIR OF POPULATED AREAS. MAXIMUM PERMISSIBLE CONCENTRATIONS OF HARMFUL SUBSTANCES IN THE WATER OF RESERVOIRS DESTINED FOR SANITARY AND RESIDENTIAL USE
A. V. Pavlov 1974 12 p refs Transl. into ENGLISH from USSR Min. of Public Health report no. 1005-73 (Moscow), 1970 Sponsored by EPA
(TR-175-74) Avail: NTIS HC $4.00

Pollutants identified in readings of atmospheric contamination are matched with values in milligrams per cubic meter of maximum single, and average daily permissible concentrations, as defined by public health requirements. Water pollutants found in reservoirs were also evaluated according to a limiting index of danger, and in values of milligrams per liter. The compilations are a result of research in the U.S.S.R. on public health tolerances. A.A.D.

N74-31870# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SOILS AND MORPHOLOGY OF CAROLINA BAYS, EASTERN SHORE, VIRGINIA M.S. Thesis
Daniel John Bliley Apr. 1974 149 p refs
Avail: NTIS HC $10.50

Carolina bay landforms were studied on the Eastern Shore of Virginia using aerial infrared imagery. Bays were delineated mainly by contrasting soil and vegetation which was enhanced on the imagery and further verified by field investigations. Typical bay morphology was found in general to be similar to descriptions from other areas. However it was observed that many bays in the study area were more nearly round, and had a more westerly orientation. Consistent strongly developed southeastern rims were not observed as have been reported from other areas. Bays were determined to be non-randomly distributed within the study area. The majority occur along the central backbone of the peninsula in a generally linear fashion and are apparently associated with larger less distinct depressions. The restriction of bay size by associated land surface may be evidenced by a number of small bays occurring on the narrow peninsula south of Wachapreague and the lack of large bays (over 2 miles in length) in the study area. All soils examined had sandy subsurface horizons indicating a sandy environment of bay formation. Size distribution of sandy fractions revealed that differential sorting probably occurred between bay rims and depressions. Author

N74-31871*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC CONVECTIVE VELOCITIES AND THE FOURIER PHASE SPECTRUM
William C. Cliff Aug. 1974 20 p refs
(NASA-TM-X-64869) Avail: NTIS HC $3.00 CSCL 04A

The relationship between convective velocity and the Fourier phase spectrum of the cross correlation is developed. By examining the convective velocity as a function of frequency, one may determine if Taylor's conversion from time statistics to space statistics is valid. It is felt that the high shear regions of the atmospheric boundary layer need to be explored to determine the validity of the use of Taylor's hypothesis for this region. Author

N74-31872*# Scientific Translation Service, Santa Barbara, Calif.
THE SIGNIFICANCE OF BIOLOGICAL FACTORS IN THE WEATHERING OF ROCKS AND MINERALS
P. V. Ivashov Washington NASA Sep. 1974 34 p refs Transl. into ENGLISH from the book "Znacheniye Biologicheskikh Facotorov v Vyvetrivanii Porod i Mineralov" Moscow, Nauka Press, 1971 p 30-50
(Contract NASw-2483)
(NASA-TT-F-15915) Avail: NTIS HC $4.75 CSCL 08G

The role of biological factors in the weathering of rocks and minerals is discussed. Based on the data presented, it is concluded that biological factors play an extremely important role. Author

N74-31873*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
RADIATIVE TRANSFER IN REAL ATMOSPHERES Technical Report, 1 Feb. - 31 Oct. 1973
Robert E. Turner Jul. 1974 108 p refs
(Contract NAS9-9784)
(NASA-CR-140199; ERIM-190100-24-T) Avail: NTIS HC $8.50 CSCL 04A

The problem of multiple radiation scattering in an atmosphere characterized by various amounts of aerosol absorption and different particle size distributions was investigated. The visible part of the spectrum was emphasized, including the effect of ozone absorption. An atmosphere bounded by a nonhomogenous, Lambertian surface was also studied, along with the effect of background radiation on target in terms of various atmospheric

and geometric conditions. Results of the investigation indicate that comtaminated atmospheres can change the radiation field by a considerable amount, and that the effect of non-uniform surface significantly alters the intrinsic radiation from a target element. The implications of these results for the recognition processing of multispectral remote sensing data is discussed.
Author

N74-31874*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
A STUDY OF SOME NINE-ELEMENT DECISION RULES Final Report, 1 Feb. - 31 Oct. 1973
Wyman Richardson Jul. 1974 46 p refs
(Contract NAS9-9784)
(NASA-CR-140203; ERIM-190100-32-T) Avail: NTIS HC $5.50 CSCL 05B

A nine-element rule is one that makes a classification decision for each pixel based on data from that pixel and its eight immediate neighbors. Three such rules, all fast and simple to use, are defined and tested. All performed substantially better on field interiors than the best one-point rule. Qualitative results indicate that fine detail and contradictory testimony tend to be overlooked by the rules.
Author

N74-31875# Indian Inst. of Geomagnetism, Bombay.
[GEOMAGNETIC RESEARCH ACTIVITIES AND DATA PROCESSING AND DISSEMINATION IN INDIA DURING 1971 - 1972] Annual Report, 1971 - 1972
1972 31 p refs
Avail: NTIS HC $4.75

The organization and activities of the Indian Institute of Geomagnetism are discussed. The observational activities include the following: (1) time service, (2) service to the Indian Navy, (3) atmospheric electricity, (4) meteorological observatory at Alibag, (5) magnetic observatories at Shillong and Port Blair/Car Nicobar, and (6) magnetic survey of the equatorial electrojet region.
Author

N74-31876# Ionospharen-Institut Breisach (West Germany).
ABSORPTIONS DATA: FREIBURG, URSI-CODE 131, JULY - SEPTEMBER 1973 [ABSORPTIONS-DATEN: FREIBURG, URSI-CODE 131, JULI - SEPTEMBER 1973]
Sep. 1973 90 p
Avail: NTIS HC $7.50

Ionospheric absorption is reported using a 'digisonde' for echo amplication. It is shown that the device produces ionograms in digitized form to measure the echo amplitudes. Tables are presented that show the echo field strength values on a decibel scale.
M.C.F.

N74-31877# Ionospharen-Institut Breisach (West Germany).
ABSORPTIONS DATA: FREIBURG, URSI-CODE 131, OCTOBER - DECEMBER 1973 [ABSORPTIONS-DATEN: FREIBURG, URSI-CODE 131, OKTOBER -DEZEMBER 1973]
Dec. 1973 69 p
Avail: NTIS HC $6.50

Daily summaries are presented for ionospheric absorption measurements during October, November, and December 1973. Measurements were made with the digisonde which is used to produce ionograms in digitized form and to calibrate echo amplitudes. Tables of median values for the E and F regions are included.
J.A.M.

N74-31878*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
RADIATION MEASUREMENTS OVER A SNOWFIELD AT AN ELEVATED SITE
Hans C. Korff (Bonn Univ.), Jeffrey J Gailiun, and Thomas H. VonderHaar Jan. 1974 38 p refs
(Grant NGR-06-002-102)
(NASA-CR-139674; CSU-ATSP-221) Avail: NTIS HC $5.00 CSCL 08L

The components of short wave radiation were measured over a snowfield in a valley of the Rocky Mountains at a height of 2700 m above sea level. Global and reflected radiation were obtained by a set of Eppley pyranometers. In addition, the direct solar radiation and the turbidity of the atmosphere were derived from pyrheliometric data on cloud-free days. Emphasis was given to the reflectance of the snowfield in relation to the position of the sun, especially at low elevation angles. These reflectance values were measured for cloudless as well as for cloudy days and compared with already published values for arctic and antarctic conditions.
Author

N74-31879*# Bendix Corp., Ann Arbor, Mich. System Div.
CONICAL SCAN IMPACT STUDY. VOLUME 1: GENERAL CENTRAL DATA PROCESSING FACILITY Final Technical Report, Apr. - Aug. 1973
Donald H. Ebert, Thomas A. Eppes, and Douglas J. Thomas Sep. 1973 110 p refs
(Contract NAS5-21903)
(NASA-CR-139088; BSR-4150-Vol-1) Avail: NTIS HC $8.50 CSCL 05B

The impact of a conical scan versus a linear scan multispectral scanner (MSS) instrument was studied in terms of: (1) design modifications required in framing and continuous image recording devices; and (2) changes in configurations of an all-digital precision image processor. A baseline system was defined to provide the framework for comparison, and included pertinent spacecraft parameters, a conical MSS, a linear MSS, an image recording system, and an all-digital precision processor. Lateral offset pointing of the sensors over a range of plus or minus 20 deg was considered. The study addressed the conical scan impact on geometric, radiometric, and aperture correction of MSS data in terms of hardware and software considerations, system complexity, quality of corrections, throughput, and cost of implementation. It was concluded that: (1) if the MSS data are to be only film recorded, then there is only a nomial concial scan impact on the ground data processing system; and (2) if digital data are to be provided to users on computer compatible tapes in rectilinear format, then there is a significant conical scan impact on the ground data processing system.
Author

N74-31880*# Bendix Corp., Ann Arbor, Mich. Systems Div.
CONICAL SCAN IMPACT STUDY. VOLUME 2: SMALL LOCAL USER DATA PROCESSING FACILITY Final Technical Report, Jun. - Aug. 1973
Donald H. Ebert, P. E. Chase, Jack Dye, W. C. Fahline, and R. H. Johnson Sep. 1973 138 p refs
(Contract NAS5-21903)
(NASA-CR-139089; BSR-4150-Vol-2) Avail: NTIS HC $10.00

The impact of a conical scan versus a linear scan multispectral scanner (MSS) instrument on a small local-user data processing facility was studied. User data requirements were examined to determine the unique system rquirements for a low cost ground system (LCGS) compatible with the Earth Observatory Satellite (EOS) system. Candidate concepts were defined for the LCGS and preliminary designs were developed for selected concepts. The impact of a conical scan MSS versus a linear scan MSS was evaluated for the selected concepts. It was concluded that there are valid user requirements for the LCGS and, as a result of these requirements, the impact of the conical scanner is minimal, although some new hardware development for the LCGS is necessary to handle conical scan data.
Author

N74-31881*# National Oceanic and Atmospheric Administration, Washington, D.C.
THE ROLE OF SATELLITES IN SNOW AND ICE MEASUREMENTS
Donald R. Wiesnet Aug. 1974 14 p refs
(NASA-CR-139671; NOAA-TM-NESS-58) Avail: NTIS HC $4.00 CSCL 08L

Earth-orbiting polar satellites are desirable platforms for the remote sensing of snow and ice. Geostationary satellites at a very high altitude (35,900 km) are also desirable platforms for many remote sensors, for communications relay, for flood warning systems, and for telemetry of data from unattended instrumentation in remote, inaccessible places such as the Arctic, Antarctic, or mountain tops. Optimum use of satellite platforms is achieved only after careful consideration of the temporal, spatial, and spectral requirements of the environmental mission. The National Environmental Satellite Service will maintain both types of environmental satellites as part of its mission.
Author

N74-31882# Stockholm Univ. (Sweden). Inst. of Meteorology.
ARTIFICIAL INCREASES OF THE STRATOSPHERIC NITROGEN OXIDE CONTENT AND POSSIBLE CONSEQUENSES FOR THE ATMOSPHERIC OZONE
Paul Crutzen 11 Feb. 1974 11 p refs
(AP-15) Avail: NTIS HC $4.00

Theoretical ozone concentrations for different values of stratospheric mixing ratios NO/NO2, ranging from 0 (natural stratosphere) to 10 to the minus 8th power (stratosphere polluted by supersonic aircraft) were calculated. The results were tabulated for both a static atmosphere and an atmosphere in motion.
Author (ESRO)

N74-31883# World Meteorological Organization, Geneva (Switzerland).
APPLICATIONS OF HYDROLOGY TO WATER RESOURCES MANAGEMENT (PLANNING AND DESIGN LEVEL)
V. Klemes 1973 121 p refs
(WMO-356; Ohr-4) Avail: NTIS HC $9.25

Different methods and concepts involved in the practical applications of hydrology and the effective use of hydrological techniques in the planning, design, and management of projects in the field of surface water resources are discussed. In particular, hydrological problems in water resources inventory, arising from water deficiency and from water excess are considered. ESRO

N74-31884# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Dec. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, DECEMBRE 1973]
Dec. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for December 1973. ESRO

N74-31885# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1974 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JANVIER 1974]
Jan. 1974 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for January 1974. ESRO

N74-31886# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Nov. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, NOVEMBRE 1973]
Nov. 1973 26 p In FRENCH and DUTCH
Avail: NTIS HC $4.50

Gecphysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during November 1973 are presented. ESRO

N74-31887# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Dec. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, DECEMBRE 1973]
Dec. 1973 26 p In FRENCH and DUTCH
Avail: NTIS HC $4.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during December 1973 are presented. ESRO

N74-31888# Army Coastal Engineering Research Center, Washington, D.C.
USE OF EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS-1) IN COASTAL STUDIES
Orville T. Magoon 1973 11 p refs Repr. from NASA/Goddard Space Flight Center ERTS-1 Symp., 29 Sep. 1973
(AD-766378; CERC-Reprint-5-73) Avail: NTIS CSCL 08/6

A few samples of the ERTS-1 imagery in coastal studies are presented. Even with the limited inspection possible of available imagery, a number of clearly demonstrated applications of ERTS to coastal studies is described. GRA

N74-31889# Stanford Research Inst., Menlo Park, Calif.
ORIGIN OF THE SUNSPOT MODULATION OF OZONE: ITS IMPLICATIONS FOR STRATOSPHERIC NO INJECTION
M. A. Ruderman and J. W. Chamberlain Apr. 1974 47 p refs
(Contract DAHC15-73-C-0370; ARPA Order 2504; SRI Proj. 3000)
(AD-779906; SRI-JSR-73-8) Avail: NTIS CSCL 04/1

The measured modulation of cosmic rays deposited in the stratosphere over a sunspot cycle produces an oscillating source of stratospheric NO with a 11-year (quasi) period. The resulting modulation of ozone over this period is calculated and is shown to give good agreement with available measurements of the time lag, the latitude dependence, and the magnitude of cyclic variations of ozone. This correlated modulation is then used to predict the effect on ozone of the injection of NO into the stratosphere from artificial sources, viz., a fleet of supersonic transports and nuclear bomb explosions in the atmosphere.
Author (GRA)

N74-31890# Aerospace Corp., El Segundo, Calif. Lab Operations.
A GLOBAL MODEL OF THERMOSPHERIC DYNAMICS. 1: WIND AND DENSITY FIELDS DERIVED FROM A PHENOMENOLOGICAL TEMPERATURE Interim Report
Stephen P. Creekmore, Joe M. Straus, Richard M. Harris, Barbara K. Ching, and Yam T. Chiu 30 Apr. 1974 61 p refs
(Contract F04701-73-C-0074)
(AD-779923; TR-0074(9260-06)-2; SAMSO-TR-74-117) Avail: NTIS CSCL 04/1

The paper describes the mathematical formulation and implementation of a numerical model of the upper atmosphere based on the equations of conservation of mass, momentum and energy in the altitude range 120-500 km. The model is three-dimensional and includes the effects of viscosity, ion drag, the Coriolis force and the nonlinear terms in the equations of motion. The Galerkin method is used as an efficient alternative to finite-difference approaches for the solution of three-dimensional partial differential equations. In the computations discussed here, the upper atmosphere is represented by a single fluid with molecular weight and temperature fields taken from the phenomenological model of Jacchia (1971). The horizontal and vertical wind fields and the density of the thermosphere are discussed, with particular attention to the diurnally averaged wind fields. Comparisons with previous theoretical and observational investigations are made. Author (GRA)

N74-31891# Aerospace Corp., El Segundo, Calif.
ION GAUGE MEASUREMENTS OF LATITUDINAL DENSITY VARIATIONS AT NIGHT Interim Report
Barbara K. Ching and Virginia L. Carter 14 May 1974 18 p refs
(Contract F04701-73-C-0074)
(AD-779924; TR-0074(4260-10)-10; SAMSO-TR-74-119) Avail: NTIS CSCL 04/1

Atmospheric densities have been obtained from a cold cathode ion gauge flown on the satellite 1972-32A in April-May 1972. The satellite orbit was inclined at 81.5 degrees in a noon-midnight configuration. Data obtained at heights between 200 and 275 km during a very quiet period have been examined for latitudinal effects. Transformed to a constant altitude of 230 km, the data show a variation on the dark side by as much as a factor of 2, the highest density being at high northern latitudes and the lowest at middle to high southern latitudes. General agreement was obtained between the data and both the Jacchia 1971 and OGO-6 models. An equatorial maximum was sometimes observed that closely resembled the pure N2-distribution as described by the OGO-6 model. Author (GRA)

N74-31892# McGill Univ., Montreal (Quebec). Dept. of Physics.
STUDIES ON THE ELECTRICAL PROPERTIES OF SALINE ICE Final Report

J. R. Addison, P. Stalinski, and E. R. Pounder 28 Feb. 1974 76 p refs
(Contract N00014-70-C-0312; NR Proj. 307-286)
(AD-780463) Avail: NTIS CSCL 08/12

Contents: An internal modification to extend the conductance ranges of the General Radio Co. Type 1615-A capacitance bridge; Electrical properties of saline ice at 1 Khz, down to -150C; An experimental programme for the measurement of the electrical properties of artificial sea ice at UHF and microwave frequencies. GRA

N74-31893# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ICE CAP ANALYSIS MECHANISMS FOR ENERGY DEPOSIT IN THE AURORAL IONOSPHERE
Robert D. Sears, John E. Evans, and Robert N. Varney 15 Jan. 1974 63 p refs
(Contract DNA01-73-C-0224)
(AD-779892; LMSC-D358174; DNA-3293F) Avail: NTIS CSCL 04/1

The purpose of the investigation is to provide analytical support to the ICE CAP program with respect to defining the possible sources of energy input to the auroral region ionosphere and their relative importance to the optical emission measurements made during Operation ICE CAP experiments. Topics discussed include: energy deposit by precipitating electrons; Joule heating; and, detection and measurement of wavelike disturbances. GRA

N74-31894# Stanford Research Inst., Menlo Park, Calif.
JOINT RADAR/SATELLITE EXPERIMENTS AT CHATANIKA, ALASKA Technical Report, Oct. 1971 - Nov. 1973
Theodore M. Watt Dec. 1973 50 p refs
(Contract DNA001-72-C-0076)
(AD-779913; DNA-3305F; TR-1) Avail: NTIS CSCL 04/1

The results of joint radar/satellite experiments at Chatanika, Alaska are reported. Two types of experiments are described: (1) simultaneous observation of electron-density profiles obtained by incoherent-scatter and topside-sounding techniques, and comparison of the two sets of results; and (2) measurement of electron density and energetic particle flux, and the combination of these measurements to obtain profiles of effective recombination coefficient. The latter experiment (2) has been completed and is described in some detail. Values of effective recombination coefficient obtained by this technique compare favorably with results reported elsewhere. Author (GRA)

N74-31895# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
FRACTURING OIL SHALE WITH EXPLOSIVES FOR IN SITU OIL RECOVERY
J. S. Miller, C. J. Walker, and J. L. Eakin Mar. 1974 110 p refs
(PB-231283/3; BM-RI-7874) Avail: NTIS HC $4.50 CSCL 08I

This report presents results of Bureau of Mines preliminary research and the field application of explosive fracturing techniques to prepare oil shale for in situ recovery of shade oil. Small-scale surface tests were conducted to determine the feasibility of using a nitroglycerin-base explosive for creating rock fractures. Surface and near-surface tests with liquid explosives showed that explosions in sheetlike layers simulating underground fractures would propagate effectively. Explosive fracturing tests were performed in oil shale formations on seven sites. The research on oil shale formations demonstrated that nitroglycerin displaced in a natural or hydraulically induced fracture would detonate and the explosion would propagate through the explosive filled fracture. Fourteen methods used to evaluate the extent of fragmentation in the explosively fractured oil shale are discussed. (Modified author abstract) GRA

N74-31896# Bureau of Mines, Dallas, Tex. Mineral Supply Field Office.
ASSESSMENT OF U.S. PETROLEUM SUPPLY WITH VARYING DRILLING EFFORTS
T. M. Garland, M. Carrales, Jr., and J. S. Conway Mar. 1974 42 p refs
(PB-231153/8; BM-IC-8634) Avail: NTIS MF $1.45; SOD HC $0.75 as I28.27:8634 CSCL 08I

This report presents a Bureau of Mines assessment of crude oil and associated gas production and reserves that would result from different drilling efforts in the lower 48 states during the 1972-85 period. The drilling effort was based upon five growth rate assumptions from the 1971 level. Additions to crude oil reserves were computed for nine cases resulting from the use of three equations for findings per foot drilled and three constant revision factors. The results presented vividly illustrate that the United States will not become self-sufficient in crude oil production by 1985 and also illustrate the lead time required to reverse the decline in oil production. Discussion is limited to three of the nine cases to provide high, intermediate, and low results. More emphasis is on the intermediate case because it in indicative of the most probable trends. The methodology and statistical data are included in the appendices. Author (GRA)

N74-31897# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
USE OF CENTRIFUGAL MEASUREMENTS OF WETTABILITY TO PREDICT OIL RECOVERY
P. B. Lorenz, E. C. Donaldson, and R. D. Thomas Feb. 1974 31 p refs
(PB-231103/3; BM-RI-7873) Avail: NTIS HC $3.25 CSCL 08I

Wettability measurements and laboratory water-flood tests were compared on synthetic and natural crude oils, treated and untreated outcrop and oilfield sandstone cores, synthetic brines with and without caustic, detergent, or phosphate additives, equilibrated and unequilibrated systems, and at 77 and 150 F. Wettability was evaluated by the Bureau of Mines method Waterflood data were fitted by emperical curves. Results showed that wettability measurements at 77 F were useful predictors of recovery. (Modified author abstract) GRA

N74-31898# Scripps Institution of Oceanography, La Jolla, Calif.
NORTH PACIFIC STUDY: PHYSICAL DATA REPORT, CRUISES 1-12, SEP. 1968 - SEP. 1971 Data Report
1974 123 p
(Contract N00014-69-A-0200-6043)
(AD-779910; SIO-Ref-73-26) Avail: NTIS CSCL 08/10

The data presented were collected on ten cruises by the USCGC Acushnet and one cruise by the RV Thomas Washington for the North Pacific Study Program. These cruises were for the purpose of deploying and servicing instrumented stations in the North Central Pacific to study the large-scale ocean and atmosphere interrelationships in the Pacific, and were funded under contracts with the Office of Naval Research. Tabulated in this report for the cruises of this program are temperature and salinity data from S/T/D lowerings and Nansen bottle casts collected for comparison with the data from the moored instrument stations. GRA

N74-31899# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PULSE SOUNDING WITH CLOSELY SPACED RECEIVERS AS A TOOL FOR MEASURING ATMOSPHERIC MOTIONS AND FINE STRUCTURE IN THE IONOSPHERE. 6: SPECTRAL ANALYSIS OF INTERLACED SETS OF DATA
Environmental Research Papers
W. Pfister 7 Mar. 1974 22 p refs
(AF Proj. 7663)
(AD-781043; AFCRL-TR-74-0125; AFCRL-ERP-470) Avail: NTIS CSCL 04/1

A pulse sounding system, like LTIRF's complex amplitude multifrequency scanner (CAMS), can be used to sample the returned echo on many parameters (antennas, frequencies, range gates). If the number of parameters is reduced, the sampling rate can be increased and used in a spectrum analysis either to improve the signal-to-noise ratio or to extend the Doppler range. The fact that for this application the data are not equally spaced, but consist of two, three or more interlaced sets of equally spaced data, requires a special treatment. The problem is formulated with three sets, according to the format of CAMS. Examples of spectral measurements are included. The case for two or four interlaced sets is discussed in Appendixes A and B. Author (GRA)

N74-31900# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PULSE SOUNDING WITH CLOSELY SPACED RECEIVERS AS A TOOL FOR MEASURING ATMOSPHERIC MOTIONS AND FINE STRUCTURE IN THE IONOSPHERE. 5: PERIOD OF CHEMICAL RELEASES AS EXAMPLE OF SPECTRAL ANALYSIS Environmental Research Papers
W. Pfister 22 Feb. 1974 43 p refs
(AF Proj. 7663)
(AD-781040; AFCRL-ERP-468; AFCRL-TR-74-0105) Avail: NTIS CSCL 04/1

The report gives a detailed description of the different steps in the processing of drift data taken with the Complex Amplitude Multifrequency Scanner (CAMS). The raw data together with preface information are digitally recorded in a format suitable for a digicoder printout. They are spectrum analyzed in two steps: Fourier spectra and combined power, phase and coherency spectra. Output is provided either as computer plot or as tape for digicoder printout. The last step is a DAASM (Doppler and Arrival Angle Measurement) display. As illustration for all these steps in the data processing an E sub S event was chosen which appeared one hour after chemical releases from rockets. Only minor attention has been given to the interpretation of the processed data. Author (GRA)

N74-31901# Utah State Univ., Logan. Electro-Dynamics Lab.
DEVELOPMENT OF A LIQUID NITROGEN COOLED FIELD WIDENED INTERFEROMETER Final Report, 1 Feb. 1972 - 30 Nov. 1973
Allan Steed and Ralph H. Haycock 1 Dec. 1973 53 p refs Sponsored in part by DNA
(Contract F19628-72-C-0156)
(AD-780545; AFCRL-TR-74-0012) Avail: NTIS CSCL 04/1

Under contract with Air Force Cambridge Research Laboratories, personnel from Electro-Dynamics Laboratories at Utah State University have developed an infrared measurement system for installation in a KC 135 aircraft. The system consists of a liquid nitrogen cooled, field widened interferometer spectrometer incorporated in a cryogenic housing and the attendant control console. The interferometer is cooled to liquid nitrogen temperature and the detector is further cooled to liquid helium temperature. A special top plate for the interferometer housing was designed and built which allows the instrument to be used on the ground. Frosting is prevented on the optical port by using cold dry nitrogen gas as a thermal barrier between the window and the atmosphere. Using the ground based system the emission spectra of the night sky from 1 - 2.7 micrometer has been resolved in less than 10 seconds. A measurement made at White sands, New Mexico is included as part of this report. (Modified author abstract) GRA

N74-31902# Utah State Univ., Logan.
INFRARED RADIANCE MODEL FOR THE AURORALLY DISTURBED ATMOSPHERE Final Report, 1 Aug. 1971 - 31 Aug. 1973
Richard H. Bishop, Ruey Y. Han, Alan W. Shaw, and Lawrence R. Megill 31 Aug. 1973 150 p refs
(Contract F19628-71-C-0257; ARPA Order 1366; AF Proj. 1366)
(AD-780659; AFCRL-TR-73-0527) Avail: NTIS CSCL 04/1

Recently, auroral observations have indicated the strong enhancement of certain infrared bands during periods of auroral activity. A theoretical model has been created in order to study the infrared processes associated with the aurora. The quantitative results of this study depend upon a thorough knowledge of the rates of all processes involved. Some of the rate constants are well known while for others only the crudest approximation is made. Qualitatively, however, results indicate that certain infrared bands of CO2, N2O, NO, and NO- are strongly enhanced during periods of auroral activity. This is primarily the result of two basic energy exchange mechanisms. The energy deposited by the primary auroral electron flux goes into increasing the internal energy of N2, O2, and O. In addition to energetic auroral particles as an energy source, electric fields are also considered. Qualitatively the results are similar except that the energy tends to be deposited at altitudes somewhat higher than in direct precipitation processes. (Modified author abstract) GRA

N74-31903# Mission Research Corp., Santa Barbara, Calif.
STIMULATED SKYGLOW Final Technical Report, 1 Aug. - 31 Dec. 1973
D. H. Archer and P. W. Tarr Jan. 1974 73 p refs
(Contract F30602-71-C-0374; Contract DNA001-73-C-0239; AF Proj. 1649)
(AD-781094; MRC-R-107; RADC-TR-74-109) Avail: NTIS CSCL 04/1

The report describes the development of a code, called ARCTIC, that is suitable for the study and analysis of auroral data. The code inputs a flux spectrum of primary electrons, incident on or in the atmosphere, with a specified magnetic dip angle and initial pitch angle, and computes the detailed energy deposition and partition in the atmosphere. The deposition subroutine is coupled to a chemistry and radiation subroutine with the result that the optical/infrared emission, as functions of altitude and time, are then determined. The code is essentially complete, except for certain refinements, and has been run for the case of a hypothetical class II - aurora.
Author (GRA)

N74-31904# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MOLECULAR OXYGEN MEASUREMENTS FROM UV ABSORPTION
Lawrence H. Weeks 27 Feb. 1974 23 p refs
(AF Proj. 6690)
(AD-780639; AFCRL-TR-74-0109; AFCRL-ERP-469) Avail: NTIS CSCL 04/1

A series of sounding rockets were launched to study the atmosphere over a day-night period. Part of this program consisted of two optical payloads for molecular oxygen. The molecular oxygen concentration was obtained from Lyman-alpha and 1450A sensors. Here the method of analysis for molecular oxygen is discussed and the results presented and compared with models and other data. The molecular oxygen concentration is measured by the technique of absorption spectroscopy, using the sun as a light source. GRA

N74-31905# Alaska Univ., College.
NOCTILUCENT CLOUD OBSERVATIONS COORDINATED WITH ROCKET TEMPERATURE SOUNDINGS IN CENTRAL ALASKA Final Report, 15 Jul. - 30 Nov. 1973
William J. Stringer 20 Mar. 1974 59 p refs
(Contract DA-ARO(D)-31-124-73-G201; DA Proj 2M0-61102-B-53B)
(AD-780936; UAG-NLC-73; AROD-11891-1-EN) Avail: NTIS CSCL 04/1

During the summer of 1973, the Geophysical Institute and the U.S. Army Meteorological Rocket Program cooperated in a small joint study to determine whether any correlation could be found between the appearance of noctilucent clouds and lower mesospheric temperature profiles. Noctilucent cloud observations were performed by the Geophysical Institute while mesospheric temperature profiles were obtained for altitudes below 70 km by parachute-borne thermistors released from standard Dart payloads carried aloft by Super Loki rocket motors. Temperature profiles obtained from grenade temperature soundings were used to extrapolate the lower mesospheric temperature profiles to the mesopause. Successful observations required temperature profiles to be obtained during clear sky conditions. (Modified author abstract) GRA

N74-31906# Coast Guard, Washington, D.C.
REPORT OF THE INTERNATIONAL ICE PATROL SERVICE IN THE NORTH ATLANTIC OCEAN, SEASON OF 1972
30 Jan. 1974 62 p refs
(AD-780537; USCG-Bull-58; USCG-188-27) Avail: NTIS CSCL 08/10

The report is 58th in a series of Annual Reports on the International Ice Patrol Service in the North Atlantic Ocean. It contains information on Ice Patrol organization, communications and operations, on ice and environmental conditions and their relationship in 1972, and on the dynamic topography surveys conducted during April, May and June 1972 GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-31907*# Systems Research Lab., Champaign, Ill.
CONTINUOUS AND DISCRETE DESCRIBING FUNCTION ANALYSIS OF THE LST SYSTEM Bi-Monthly Report
B. C. Kuo, G. Singh, and R. A. Yackel 1 Nov. 1973 59 p
(Contract NAS8-29853)
(NASA-CR-120321) Avail: NTIS HC $6.00 CSCL 14B

A describing function of the control moment gyros (CMG) frictional nonlinearity is derived using the analytic torque equation. Computer simulation of the simplified Large Space Telescope (LST) system with the analytic torque expression is discussed along with the transfer functions of the sampled-data LST system, and the discrete describing function of the GMC frictionality. F.O.S.

N74-31908*# Alabama Univ., University.
ANALYSIS OF THE RELATIVISTIC ORBITING GYROSCOPE EXPERIMENT Final Report, 14 May - 30 Nov. 1973
Alton C. Coulter 30 Nov. 1973 25 p refs
(Contract NAS8-29900)
(NASA-CR-120317) Avail: NTIS HC $4.25 CSCL 14B

A gyroscope experiment designed to measure both the geodetic and the Lense-Thirring precessions to an accuracy of 0.01 arc-second per year appears economically and technically feasible. It is estimated that an accuracy of about one part in 10 to the 11th power in an Eotvos experiment would be required to detect a situation in which the weak interaction contributed to the inertial masses but not the gravitational masses of nuclei; a correspondingly higher accuracy in the experiment is required to detect the situation where the weak interaction contributed to the gravitational masses some fraction between zero and one of its contribution to the inertial masses. Author

N74-31909*# Visidyne, Inc., Burlington, Mass.
STUDY ON THE EFFECT OF CONTAMINATION ON THE PERFORMANCE OF X-RAY TELESCOPES Final Report
William R. Neal and William P. Reidy 24 Sep. 1973 63 p refs
(Contract NAS8-28083)
(NASA-CR-120323; VI-199) Avail: NTIS HC $6.25 CSCL 20F

Modifications were made to the X-ray reflectometer located at the Space Sciences Laboratory, Marshall Space Flight Center. One was an automatic drive for the Large Micrometer Head. This system, interfaced with the Hewlett Packard Computer System, is used to record data and provides the X-ray reflectometer with an automated data-taking capability. Using this system, a complete scatter curve can be obtained automatically. Previously, it was necessary to manually reset the system after recording for each data point in the scatter curve. The second modification provided an externally controlled electrical drive to move the microfocus X-ray source along its axis. With this modification, one can translate the X-ray source while it is operating to locate the position providing maximum count rate. Author

N74-31910*# Ball Bros. Research Corp., Boulder, Colo.
TEMPERATURE COMPENSATED SLEEVE TYPE MIRROR MOUNT Final Report
4 Oct. 1973 4 p Prepared for Calif. Inst. of Tech.
(Contracts NSR-05-002-071; NAS8-30190; Caltech-40-725999-A)
(NASA-CR-139593) Avail: NTIS HC $4.00 CSCL 14B

The primary mirror of a large (26-inch diameter aperture) solar telescope was made of glass ceramic and designed with an integral hub on the back of the center of the mirror. This permits heat from the mirror to radiate off its back to a nearby cold plate. To permit mounting without high stresses, the hub was ground down to a smooth cylindrical surface 3.5 inch in diameter. The ground surface was then acid-etched to remove 0.007 inch (on the diameter) by immersion for five minutes in a mixture of four parts 92% sulfuric acid and three parts 50% hydrofluoric acid. The acid etching removes microcracks from the ground Cer-Vit surface. An Invar sleeve was fabricated to fit over the hub with about 0.010 inch radial (0.020 inch diametral) clearance. Author

N74-31911*# Battelle Columbus Labs., Ohio.
HOLOGRAPHIC RECORDING MATERIALS DEVELOPMENT Final Report, 29 May 1973 - 28 May 1974
28 May 1974 49 p refs
(Contract NAS1-12324)
(NASA-CR-132478) Avail: NTIS HC $3.25 CSCL 14E

Developments in the area of organic cis-trans isomerization systems for holographic memory applications are reported. The chemical research effort consisted of photochemical studies leading to the selection of a stilbene derivative and a polymer matrix system which have greatly improved refractive index differences between the cis and trans isomers as well as demonstrated efficiency of the photoisomerization process. In work on lithium niobate effects of sample stoichiometry and of read and write beam polarizations on recording efficiency were investigated. LiNbO3 was used for a study of angular sensitivity and of capability for simultaneous recording of extended objects without interference. The current status of LiNbO3 as a holographic recording material is summarized. Author

N74-31912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON-LINE CALIBRATION OF HIGH-RESPONSE PRESSURE TRANSDUCERS DURING JET-ENGINE TESTING
E. C. Armentrout 1974 23 p Proposed for presentation at Aerospace Eng. and Manufacturing Meeting, San Diego, Calif., 30 Sep. - 3 Oct. 1974; sponsored by Soc. of Automotive Engr.
(NASA-TM-X-71599) Avail: NTIS HC $3.00 CSCL 14B

Jet engine testing is reported concerned with the effect of inlet pressure and temperature distortions on engine performance and involves the use of numerous miniature pressure transducers. Despite recent improvements in the manufacture of miniature pressure transducers, they still exhibit sensitivity change and zero-shift with temperature and time. To obtain meaningful data, a calibration system is needed to determine these changes. A system has been developed which provides for computer selection of appropriate reference pressures selected from nine different sources to provide a two- or three-point calibration. Calibrations are made on command, before and sometimes after each data point. A unique no leak matrix valve design is used in the reference pressure system. Zero-shift corrections are measured and the values are automatically inserted into the data reduction program. Author

N74-31913*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF THE VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) RADIOMETRIC PROBLEM
I. L. Goldberg Jul. 1974 47 p
(NASA-TM-X-70723; X-726-74-213) Avail: NTIS HC $5.50 CSCL 14B

Variations in bias radiation, on the detector as a function of scan mirror position, are reported for the VTPR instruments presently in orbit. Tests in the laboratory show that this bias radiation disappears when optical baffles are added. A detailed analysis explains quantitatively the observed bias variation which is due to the extraneous field-of-view of the detector, and the variation in magnitude of the far field-of-view solid angle as a function of mirror position. Author

N74-31914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOURIER SPECTROSCOPY AND PLANETARY RESEARCH
R. A. Hanel and V. G. Kunde Aug. 1974 120 p refs Submitted for publication
(NASA-TM-X-70735; X-622-74-238) Avail: NTIS HC $9.00 CSCL 14B

The application of Fourier Transform Spectroscopy (FTS) to planetary research is reviewed. The survey includes FTS observations of the sun, all the planets except Uranus and Pluto, the Galilean satellites and Saturn's rings. Instrumentation and scientific results are considered and the prospects and limitations

of FTS for planetary research in the forthcoming years are discussed. Author

N74-31915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFORMATION CONTENT OF IRIS SPECTRA
John C. Price Jun. 1974 38 p refs Submitted for publication
(NASA-TM-X-70721; X-913-74-209) Avail: NTIS HC $5.00 CSCL 14B

Spectra from the satellite instrument IRIS (infra red interferometer spectrometer) were examined to find the number of independent variables needed to describe these broadband high spectral resolution data. The radiated power in the atmospheric window from 771 to 981/cm was the first parameter chosen for fitting observed spectra. At succeeding levels of analysis the residual variability (observed spectrum - best fit spectrum) in an ensemble of observations was partioned into spectral eigenvectors. The eigenvector describing the largest fraction of this variability was examined for a strong spectral signature; the power in the corresponding spectral band was then used as the next fitting parameter. The measured power in nine spectral intervals, when inserted in the spectral fitting functions, was adequate to describe most spectra to within the noise level of IRIS. Considerations of relative signal strength and scales of atmospheric variability suggest a combination sounder (multichannel-broad field of view) scanner (window channel-small field of view) as an efficient observing instrument. Author

N74-31916# Defence Standards Labs., Maribyrnong (Australia).
CORRECTION PROGRAM FOR QUANTITATIVE ELECTRON PROBE MICROANALYSIS: MODIFICATIONS
N. M. Buckland Jun. 1974 25 p refs
(TN-335) Avail: NTIS HC $4.25

Modifications made to a correction program for electron probe microanalysis are outlined. Changes include an added subroutine to calculate atomic concentration and a revised fluorescence correction subroutine. Author

N74-31917# Communications Research Centre, Ottawa (Ontario).
FIELD TRIALS OF THE CRC UHF RADIOMETER AT CHURCHILL FALLS AND LAKE MELVILLE LABRADOR
G. N. Reed and R. E. Barrington Jun. 1974 42 p refs
(CRC-1252) Avail: NTIS HC $5.25

A series of field tests carried out with UHF radiometers in Labrador during the winter of 1972-1973 is described. The purpose of the experiment was to determine the value of radiometric techniques for the measurement of ice thickness on Lake Melville and for detecting Frazil ice concentrations in the reservoir of the Churchill Falls hydro-electric station. A comprehensive technical description is given of the two radiometer systems used in the experiment. A summary is made of the test program and the information derived from the analysis of the radiometer data is compared with ground-truth measurements. It is concluded that radiometers of the type used in these investigations are effective tools for detecting the build-up of Frazil ice in fast flowing waterways. They appear, however, to have limited value in the study of brackish ice such as that encountered on Lake Melville. Author

N74-31918*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND EVALUATION OF A FILTER SPECTROMETER CONCEPT FOR FACSIMILE CAMERAS
W. Lane Kelly, IV, Daniel J. Jobson, and Carroll W. Rowland Washington Aug. 1974 18 p refs
(NASA-TN-D-7717; L-9656) Avail: NTIS HC $3.00 CSCL 14E

The facsimile camera is an optical-mechanical scanning device which was selected as the imaging system for the Viking '75 lander missions to Mars. A concept which uses an interference filter-photosensor array to integrate a spectrometric capability with the basic imagery function of this camera was proposed for possible application to future missions. This paper is concerned with the design and evaluation of critical electronic circuits and components that are required to implement this concept. The feasibility of obtaining spectroradiometric data is demonstrated, and the performance of a laboratory model is described in terms of spectral range, angular and spectral resolution, and noise-equivalent radiance. Author

N74-31919*# Research Triangle Inst., Research Triangle Park, N.C. Engineering and Environmental Sciences Div.
A FOLLOW-ON STUDY FOR MINIATURE SOLID-STATE PRESSURE TRANSDUCER Final Report, Dec. 1970 - Jun. 1974
Aug. 1974 153 p refs
(Contract NAS1-9005)
(NASA-CR-132486) Avail: NTIS HC $5.00 CSCL 14B

The activities of a developmental program to design, fabricate and test an absolute pressure transducer based upon the piezojunction properties of silicon are summarized. The prime problem addressed is the development of a housing capable of applying the high stress levels needed for sensitive piezojunction operation but at the same, free from the creep effects and the fragility that limit the usefulness of previous designs. The first part of the report describes the initial fabrication and test and reviews the theory of sensor performance. The second part incorporates two recommendations of the first part (the use of commercially manufactured silicon planar mesa diodes and the adoption of an all-silicon structure for loading) and presents some preliminary test data on the transducers thus fabricated. These initial measurements show much improved performance over any previously fabricated piezojunction transducers but testing is incomplete and several problems in manufacturing technology remain. Author

N74-31920*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COSMIC DUST COMPOSITION ANALYZED WITH A SPARK ION SOURCE
Siegfried Auer Aug. 1974 12 p refs Submitted for publication
(NASA-TM-X-70741; X-672-74-240) Avail: NTIS HC $4.00 CSCL 14B

Simulated iron micrometeoroids were fired unto a capacitor-type micrometeoroid detector which responded to an impact with a spark. Large ion currents were extracted from the spark and analyzed in a crude ion time-of-flight mass spectrometer. The mass spectra show the elements of both detector and particle materials. Author

N74-31921# Translation Consultants, Ltd., Arlington, Va.
STUDY ON ATOMIC ABSORPTION SPECTROPHOTOMETRY INTERFERENCE
H. Rampon 1974 35 p refs Transl. into ENGLISH from Chim. Anal. (Paris), v. 15, no. 12, 1969 p 627-638 Sponsored by EPA
(TR-183-74) Avail: NTIS HC $4.75

The direct method of measuring interference, the method of dosed additions, and causing the appearance of an interference are reviewed to provide introductory information to a detailed discussion of interference phenomena in atomic absorption spectrophotometry. The adverse effects of interference are defined, and control parameters are discussed as means for their suppression. Interactions resulting from emission of flame are described, along with both curative and preventive methods for minimizing them. Spectral interference, matrix interference (such as viscosity and concentration of dissolved salts), and chemical interference are also discussed in terms of their causes, and methods for their control. A.A.D.

N74-31922# Translation Consultants, Ltd., Arlington, Va.
DUST MEASUREMENTS IN FLOWING GASES RECORDING MEASURING SYSTEMS, PHOTOELECTRIC MEASURING DEVICES, CALIBRATION
1974 15 p Transl. into ENGLISH from VDI Handbook, Dust, register no. 4; VDI Handbook, Preservation of Air Purity, register no. 8 Sponsored by EPA
(TR-90-74; VDI-3672) Avail: NTIS HC $4.00

Techniques for calibrating photoelectric measuring devices operating on the principle of light attenuation are reported. The device is designed to indicate or record particle concentrations within specific ranges of dusts with approximately constant optical

qualities as covered by calibration. Constant particle size distribution is also approximated by the device. Author

N74-31923*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A DYNAMIC PRESSURE GENERATOR FOR CHECKING COMPLETE PRESSURE SENSING SYSTEMS INSTALLED ON AN AIRPLANE
Diane M. DeMarco Sep. 1974 12 p refs
(NASA-TM-X-56026) Avail: NTIS HC $4.00 CSCL 14B

A portable dynamic pressure generator, how it operates, and a test setup on an airplane are described. The generator is capable of providing a sinusoidal pressure having a peak-to-peak amplitude of 3.5 N/sq cm (5 psi) at frequencies ranging from 100 hertz to 200 hertz. A typical power spectral density plot of data from actual dynamic pressure fluctuation tests within the air inlet of the YF-12 airplane is presented. Author

N74-31924*# Kanner (Leo) Associates, Redwood City, Calif.
THE SCATTERED LIGHT COMPARATIVE BEAM ANEMOMETER. A LASER ANEMOMETER FOR THE MEASUREMENT OF THREE VELOCITY COMPONENTS
W. J. Hiller and G. E. A. Meier Washington NASA Aug. 1974 29 p refs Transl. into ENGLISH of "Das Streulichtvergleichsstrahlanemometer, ein Laseranemometer zur Messung von drei Geschwindigkeitskomponenten", Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, report 3/1972, Jul. 1972 32 p
(Contract NASw-2481)
(NASA-TT-F-15888; Rept-3/1972) Avail: NTIS HC $4.50 CSCL 14B

The self-aligning reference beam method for simultaneous measurement of three components of flow velocity is described. The characteristic features of this method consist in that both the reference beam and the object beam are produced by scattering and that the interference takes place in concentric wave systems. Velocity measurements using this method in water and air flows with He, Ne and argon lasers as light sources and photodiodes as photodetectors are described. Author

N74-31925*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
COLLECTING EFFICIENCY OF A CYLINDRICAL MIRROR ELECTRON ENERGY ANALYZER WITH PRERETARDING LENS
J. L. Gardner and James A. R. Samson [1974] 20 p refs Sponsored by NASA and NSF
(NASA-CR-139662) Avail: NTIS HC $14.00 CSCL 14B

The electron collecting efficiency of a cylindrical mirror energy analyzer incorporating retardation of the electrons prior to analysis has been determined over the range 0 to 30 eV by two methods. The first method requires the use of a vacuum ultraviolet monochromator to produce monoenergetic electrons of different energies; the second method involves measuring the energy-brightness relationship of the retarding optics and should be applicable to any deflection analyzer with pre-retarding optics. The results of the two methods are compared and the limitations of the latter method are discussed. Author

N74-31926*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SYSTEMATIC MONITORING AND EVALUATION OF M7 SCANNER PERFORMANCE AND DATA QUALITY Technical Report, 1 Feb. - 31 Oct. 1973
S. Stewart, D. Christenson, and L. Larsen Jul. 1974 174 p
(Contract NAS9-9784)
(NASA-CR-140198; ERIM-190100-23-T) Avail: NTIS HC $11.75 CSCL 14B

An investigation was conducted to provide the information required to maintain data quality of the Michigan M7 Multispectral scanner by systematic checks on specific system performance characteristics. Data processing techniques which use calibration data gathered routinely every mission have been developed to assess current data quality. Significant changes from past data quality are thus identified and attempts made to discover their causes. Procedures for systematic monitoring of scanner data quality are discussed. In the solar reflective region, calculations of Noise Equivalent Change in Radiance on a permission basis are compared to theoretical tape-recorder limits to provide an estimate of overall scanner performance. M7 signal/noise characteristics are examined. Author

N74-31927*# Stanford Univ., Calif. Guidance and Control Lab.
ERROR MODELING OF PRECISION ORIENTATION SENSORS IN A FIXED BASE SIMULATION Ph.D. Thesis
David L. Klinger Jul. 1974 217 p refs Sponsored in part by Lockheed Missiles and Space Co.
(Grant NGR-05-020-019; Contract F33615-72-C-1297)
(NASA-CR-139672; SUDAAR-481) Avail: NTIS HC $14.00 CSCL 14B

Models of noise and dynamic characteristics of gyro and autocollimator for very small signal levels are presented. Measurements were evaluated using spectral techniques for identifying noise from base motion. The experiment was constructed to measure the precession, due to relativistic effects, of an extremely precise earth-orbiting gyroscope. The design goal for nonrelativistic gyro drift is 0.001 arcsec per year. An analogous fixed base simulator was used in developing methods of instrument error modeling and performance evaluation applicable to the relativity experiment sensors and other precision pointing instruments. Analysis of autocollimator spectra uncovered the presence of a platform gimbal resonance. The source of resonance was isolated to gimbal bearing elastic restraint properties most apparent at very small levels of motion. A model of these properties which include both elastic and coulomb friction characteristics is discussed, and a describing function developed. Author

N74-31928# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
VERIFICATION OF THE OPTICAL SYSTEM OF THE TRACKING FIELD EXPERIMENT D2B OBJECTIVE IN CONCORDANCE WITH THE D2B-021 PROJECT (FLIGHT MODEL) [VERIFICATION DU SYSTEME OPTIQUE DE L'OBJECTIF D2B ERC CONFORME AU PLAN D2B-021 (MODELEDE VOL)]
M. Detaille 11 Sep. 1972 13 p In FRENCH Supplement to OPT-054-72
(OPT-070-72) Avail: NTIS HC $4.00

The results of optical spot diagram tests for the compound objective used for the D-2B satellite are presented. Ray tracing calculations were performed using two different computer programs. Corrections to the lenses, required by the optical filters' thicknesses, are presented. The corresponding defocusing was determined. ESRO

N74-31929# English Electric Valve Co., Ltd., Chelmsford (England).
DEVELOPMENT OF A UV/VISIBLE IMAGE CONVERTER WITH IMAGE MOTION STABILIZATION
B. R. Garfield Jun. 1973 35 p refs
(Contract ESTEC-892/69-AA)
(ESRO-CR(P)-217; Rept-56/5-1) Avail: NTIS HC $4.75

The development of a UV/visible image converter for astronomic photometry and spectroscopy from satellites and sounding rockets is reported. Two versions of the UV convertor are described: a diode type with LiF window, and a triode type with image motion stabilization (IMS). The results of performance tests show that a UV-visible convertor satisfying the requirements is feasible. Further improvements could be achieved in background noise, deflection sensitivity, and input image plane. ESRO

N74-31930# Allen Clark Research Centre, Towcester (England).
SOLID STATE IMAGING TECHNIQUES. FEASIBILITY STUDY Final Report
H. Blackburn, K. J. S. Cave, J. F. Dickson, D. V. Eddols, D. E. Hooper, P. C. Newman, and D. A. Robinson Apr. 1974 211 p refs Prepared for Plessey Co., Ltd.
(Contracts ESTEC-1971/73-BS; CD-65370)
(ESRO-CR(P)-415) Avail: NTIS HC $13.75

Solid state imaging in the visible spectrum using silicon is considered and the performance and technology of the various imaging techniques are discussed in detail. It is concluded that broadcast quality imaging devices could be produced by 1980 using several techniques but the much better performance and video signal quality possible with buried-channel CCD should make this the most attractive solution. A survey of the current

state-of-the-art with silicon imaging devices is given. Sections dealing with solid state detectors other than silicon, video amplifiers and signal processing techniques are also included as appendices to the main report. Author (ESRO)

N74-31931# Panametrics, Inc., Waltham, Mass.
MEASUREMENT OF ELASTIC MODULI OF MATERIALS AT ELEVATED TEMPERATURE Final Report
C. A. Carey, E. H. Carnevale, J. Chen, K. A. Fowler, and G. S. Larson 31 May 1974 571 p refs
(Contract N00014-73-C-0023; NR Proj. 384-320)
(AD-780231) Avail: NTIS CSCL 14/2

Ultrasonic measurement of elastic properties of solids at elevated temperature comprises the central theme in the report of some twelve years of R and D under the support of the ONR Acoustics Branch. The principal methods used were momentary contact with pressure coupling, for bulk specimens of cross-sectional dimensions large compared to wavelength, and continuous contact, with welded joints, for wires and rods of cross-sectional dimensions small compared to wavelength. The bulk specimens were tested with broadband pulses or rf bursts having frequencies typically above 1 MHz. The wires were tested with pulses having 0.1 MHz as a typical center frequency. Other topics include: transducers, velocimetry, spectrum analysis, infrasonic measurements of moduli in plastic tensile test specimens, measurement of polymerization, and applications of ultrasonics such as nondestructive testing, acoustic emission, thermometry, flowmetry and process control. (Modified author abstract) GRA

N74-31932# Army Aviation Systems Test Activity, Edwards AFB, Calif.
FLIGHT EVALUATION: J-TEC AIRSPEED SYSTEM Final Report, 17 Nov. - 19 Mar. 1973
Floyd Dominick, Barclay H. Boirun, James S. Kishi, and Robert P. Jefferis Apr. 1974 54 p refs
(AD-780019; USAASTA-71-30-4; FR-4) Avail: NTIS CSCL 01/4

Airspeed calibration tests were conducted on the J-TEC Associates, Inc. Model VA-210 true airspeed sensor to determine its suitability for operational and flight test use as a helicopter and V/STOL aircraft airspeed instrument. The J-TEC system operates on the principle of counting vortices shed by a flubb body (cylindrical post) in the airstream. (Modified author abstract) GRA

N74-31933# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
DEVELOPMENT OF AN OPTICAL RATE SENSOR Final Report, 1 May - 31 Oct. 1973
Wilbur A. Carrington and Ronald J. Fredericks Nov. 1973 257 p
(Contract N00014-73-C-0377)
(AD-779911; GRR-004-0474) Avail: NTIS CSCL 17/7

The report documents the results of a feasibility study program in optical rate sensing by a unique technique of differential phase shift measurement between counter-traveling light beams forming a closed path. The program involved the analysis of component error sources in such a sensor and the testing of critical individual components to verify the results of analysis. Such a sensor possesses many of the attributes of the ring laser gyro without the problem of frequency lock-in which is characteristic of that device. It also offers the potential of size reduction without performance degradation through the use of fiber or integrated optics for effective area increase and replacement of the gas laser with a solid state source. (Modified author abstract) GRA

N74-31934# Radio Corp. of America, Princeton, N.J.
CHARGE-COUPLED SCANNED IR IMAGING SENSORS Semiannual Technical Report, 29 Jun. - 28 Dec. 1973
Elliott S. Kohn and Melvin L. Schultz 14 Jan. 1974 65 p refs
(Contract F19628-73-C-0282; ARPA Order 2444)
(AD-780546; PRRL-74-CR-1; AFCRL-TR-74-0056) Avail: NTIS CSCL 17/5

A program is in progress directed toward showing the feasibility of infrared sensitive charge-coupled imagers by constructing imaging arrays. The detectors are of both the Schottky-barrier type and the photoconductive type. The first device objective is a 64 x 1 array of palladium silicide on p-silicon Schottky-barrier diodes that couple into a three-phase CCD shift-register. Sensitivity is expected in the 2- to 3-micrometer region. Barriers produced with other metals can detect radiation in the 3- to 5-micrometer window useful for thermal imaging. New ideas are incorporated into the design so that the CCD does not have to handle the background signal even if frame comparison should be necessary. Test Schottky barriers have been made to permit measurement of sensitivity and dark current. Custom-designed circuitry has been built to provide the complex pulse waveforms required for the 64 x 1 array. (Modified author abstract) GRA

N74-31935# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
A HIGH FREQUENCY BURST SIGNAL PROCESSOR FOR LASER VELOCIMETER APPLICATIONS Interim Report, 26 Aug. 1971 - 30 Jun. 1973
Ronald E. Zammit, Michael K. Pedigo, and Warren H. Stevenson 31 Jan. 1974 47 p refs
(Contract DAAH01-72-C-0089; DA Proj. 1M2-62303-A-214)
(AD-780722; RD-CR-74-4) Avail: NTIS CSCL 20/4

Different types of Laser Doppler Anemometer (LDV) processors are discussed. The electronic circuit for a Doppler burst processor developed at Purdue University is described in detail. In use with a differential Doppler LDV optical system, this circuit provide a data rate up to 100 KHz, with a maximum of 100 MHz. Doppler frequency, results of preliminary velocity measurements in a two-dimensional transonic nozzle are presented. Author (GRA)

N74-31936# Defense Documentation Center, Alexandria, Va.
INFRARED DETECTORS Report Bibliography, Dec. 1960 - Dec. 1973
Jun. 1974 325 p refs
(AD-780725; DDC-TAS-74-2523) Avail: NTIS CSCL 17/5

The bibliography contains unclassified and unlimited citations on infrared detectors. These citations are studies and analyses pertaining to detection techniques, equipment, refrigeration systems, instrumentation, sensitivity, reliability, design, measurement, and performance engineering. Computer generated indexes of Corporate Author/Monitoring Agency, Subject, Title, and Personal Author are provided. Author (GRA)

N74-31937# General Research Corp., Santa Barbara, Calif.
PHOTOMETRIC ANALYSIS TECHNIQUES STUDY Final Report, 1 Jul. 1973 - 25 Feb. 1974
R. G. Utley and H. S. Ostrowsky Jul. 1974 105 p refs
(Contract F04701-73-C-0308; ARPA Order 2437)
(AD-781146; GRC-CR-2-456; SAMSO-TR-74-100) Avail: NTIS CSCL 22/2

The report describes some studies made on the application of pattern recognition techniques to the Space Object Identification (SOI) problem using passive photometric signature data. Both simulated and measured passive photometric data (primarily, the latter) on satellite objects were compared using a variety of techniques in both the time and frequency domains. Different sample spaces with dimensionalities ranging from 14 to 50 were tested, with Principal Components Analysis being used in an effort to reduce the effective number of dimensions to a small subset with minimal loss of information. The GRC Mode Determination algorithm was then applied to the sample points in the reduced subsets to compare data from the different satellite/observer pairs in order to ascertain the extent to which this type of data processing is able to separate objects which are different and group together those which are in fact similar. (Modified author abstract) GRA

N74-31938# Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.
EVALUATION OF A MICROWAVE-INDUCED PLASMA SPECTROMETER FOR TRACE ANALYSIS Environmental Protection Technology Series
William Rudolf Seitz Jan. 1974 26 p refs
(PB-231390/6; EPA-660/2-73-009; W74-06841) Avail: NTIS MF $1.45; SOD HC $0.65 as EP1 23:660-2-73-009 CSCL

07D

A low pressure microwave-induced plasma in helium was evaluated as an excitation source for spectrochemical analysis of trace metals in water. The sample was introduced by evaporating a 5-microliter drop of solution on a wire filament and atomizing the solids by the discharge of a capacitor through the filament. The height of the resulting pulse from the photo detector was automatically recorded. Repeatability was about 10% and detection limits were 1 to 25 pg for As, Cd, Hg, and Pb. Slopes of calibration curves depended strongly on matrix and filament effects and the maximum solids loading of the filament was about 5 micrograms. GRA

N74-31939# Bendix Research Labs., Southfield, Mich.
DEVICE FOR COLLECTION AND ASSAY OF AMBIENT GASES Environmental Protection Technology Series
Peter Tsang Dec. 1973 113 p refs
(Contract EPA-68-02-0657)
(PB-231364/1; EPA-650/2-74-006) Avail: NTIS HC $4.50 CSCL 07D

Simple collection and assay of NO and NO2 using solid chemical absorbents was proven feasible. The selective collection of these oxides is possible with a tandem arrangement of two absorbent cartridges: The first, containing triethanolamine hydrochloride packing, completely absorbs NO2 from the air sample without affecting the NO concentration. The second, filled with cobalt oxide packing, quantitatively removes NO. These collected oxides are later eluted and analyzed separately. The interface devide developed to transfer the sample for analysis accepts one collector cartridge and heats it to a temperature which releases the nitrogen oxide. When cooled the collector cartridges are ready for reuse in sample collection. The identification and characterization of solid chemical absorbents, their evaluations, and interference studies are described. Additional experimental techniques and data analysis is presented. A weatherproof collection system was built for field collection. Recommendations for further work are detailed. GRA

N74-31940# National Environmental Research Center, Research Triangle Park, N.C. Chemistry and Physics Lab.
PERFORMANCE SPECIFICATIONS FOR STATIONARY SOURCE MONITORING SYSTEMS FOR GASES AND VISIBLE EMISSIONS
John S. Nader, Frederic Jaye, and William Conner Jan. 1974 77 p refs
(PB-230934/2; EPA-650/2-74-013) Avail: NTIS HC $7.00 CSCL 13B

This report provides a technical basis for the selection of stationary-source monitors that are required by Federal, State, or local regulations for emissions. The document identifies performance parameters, gives specifications and details test procedures to verify the specifications. Examples of the specifications and test procedures are provided for monitoring systems applied to gases and visible emissions. Technical data used for the specifications are based on the results of laboratory and field studies. GRA

N74-31441 Thomson-CSF, Issy les Moulineaux (France). Groupe Optronique de la Div.
NEW CONCEPTS OF VISUALIZATION FOR AIRCRAFT AND SPACE SHUTTLES [NOUVEAUX CONCEPTS DE VISUALISATION POUR AVIONS ET NAVETTES SPATIALES]
M. Coussediere *In* AGARD Advan. in Control Systems May 1974 9 p In FRENCH (For availability see N74-31429 21-02)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-31941*# IIT Research Inst., Chicago, Ill.
THEORETICAL STUDY OF PRODUCTION OF UNIQUE GLASSES IN SPACE Annual Report, 1 Jul. 1973 - 31 Jun. 1974
D. C. Larsen 23 Jul. 1974 71 p refs
(Contract NAS8-29850; IITRI Proj. D6087)
(NASA-CR-120417; AR-1) Avail: NTIS HC $6.75 CSCL 13H

Analytical functional relationships describing homogeneous nucleation and crystallization in various supercooled liquids were developed. The time and temperature dependent relationships of nucleation and crystallization (intrinsic properties) are being used to relate glass forming tendency to extrinsic parameters such as cooling rate through computer simulation. Single oxide systems are being studied initially to aid in developing workable kinetic models and to indicate the primary materials parameters affecting glass formation. The theory and analytical expressions developed for simple systems is then extended to complex oxide systems. A thorough understanding of nucleation and crystallization kinetics of glass forming systems provides a priori knowledge of the ability of a given system to form a glass. Author

N74-31942*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
ELECTROMAGNETIC CONTAINERLESS PROCESSING REQUIREMENTS AND RECOMMENDED FACILITY CONCEPT AND CAPABILITIES FOR SPACE LAB Final Report
R. T. Frost, H. L. Bloom, L. J. Napaluch, E. H. Stockhoff, and G. Wouch 13 May 1974 168 p refs
(Contract NAS8-29680)
(NASA-CR-120401) Avail: NTIS HC $11.50 CSCL 13H

Containerless melting, reaction, and solidification experiments and processes which potentially can lead to new understanding of material science and production of new or improved materials in the weightless space environment are reviewed in terms of planning for spacelab. Most of the experiments and processes discussed are amenable to the employment of electromagnetic position control and electromagnetic induction or electron beam heating and melting. The spectrum of relevant properties of materials, which determine requirements for a space laboratory electromagnetic containerless processing facility are reviewed. Appropriate distributions and associated coil structures are analyzed and compared on the basis of efficiency, for providing the functions of position sensing, control, and induction heating. Several coil systems are found capable of providing these functions. Exchangeable modular coils in appropriate sizes are recommended to achieve the maximum power efficiencies, for a wide range of specimen sizes and resistivities, in order to conserve total facility power. Author

N74-31943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAINSHAFT SEALS FOR SMALL GAS TURBINE ENGINES
Lawrence P. Ludwig and Peter Lynwander (Avco Lycoming Div.) 1974 22 p refs Proposed for presentation at the Lubrication Conf., Montreal, 8-10 Oct. 1974; sponsored by American Society of Lubrication Engineers and ASME
(NASA-TM-X-71558; E-7983) Avail: NTIS HC $3.00 CSCL 11A

An experimental evaluation of mainshaft seals for small gas turbine engines was conducted with shaft speeds to 213 m/s (700 ft/sec), air pressures to 148 Newtons per square centimeter abs. (215 psia), and air temperatures to 412k(282 F). A radial face seal incorporating self-acting geometry for lift augmentation was evaluated. In addition, three conventional carbon seal types (face, circumferential segmented, and rotating ring) were run for comparison. Test results indicated that the conventional seals used in this evaluation may not be satisfactory in future advanced engines because of excessive air leakage. On the other hand, the self-acting face seal was shown to have the potential capability of limiting leakages to one-half that of the conventional face seals and one-fifth that of conventional ring seals. A 150-hour endurance test of the self-acting face seal was conducted. Author

N74-31944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURE-VISCOSITY MEASUREMENTS FOR SEVERAL LUBRICANTS TO 5.5 x 10 TO THE 8th POWER NEWTONS PER SQUARE METER (8 x 10 TO THE 4th psi) AND 149 C

(300 F)
William R. Jones, Robert L. Johnson, Ward O. Winer (Georgia Inst. of Tech., Atlanta), and David M. Sanborn (Georgia Inst. of Tech., Atlanta) Washington Aug. 1974 39 p refs
(NASA-TN-D-7736; E-7952) Avail: NTIS HC $3.25 CSCL 11H

A capillary viscometer was used to measure viscosity as a function of pressure, temperature, and shear stress for a number of lubricants. The conditions under which the measurements were made are specified. The results obtained for each material are analyzed. It was determined that all pressure-viscosity coefficients decreased with increasing temperature. Data from other techniques such as optical elastohydrodynamics, oscillating crystal, and low shear capillary viscometry were compared with the results obtained. Author

N74-31945*# Franklin Inst. Research Labs., Philadelphia, Pa.
START-STOP TESTING OF TWO SELF-ACTING AIR-LUBRICATED SPIRAL GROOVE THRUST BEARING COATINGS Final Report
J. D. Dunfee and W. Shapiro Apr. 1974 72 p
(Contract NAS3-17856)
(NASA-CR-134673; FIRL-F-C3691) Avail: NTIS HC $6.75 CSCL 13I

Start-stop tests were conducted on air-lubricated spiral-groove thrust bearings. Application of a matrix-bonded molybdenum disulfide (MoS_2) coating over a porous chrome oxide coating resulted in significantly lower friction, compared to bearings coated with chrome oxide only. The MoS_2 coated bearing sustained 15,000 start-stop cycles at a maximum of 3600 rpm. Each cycle was 15 seconds on, 30 seconds off. The chrome oxide coated bearing failed by local welding after 2030 cycles. Both types of coatings exhibited early failures under higher thrust loads when operating films were insufficient to sustain the load without overheating. Author

N74-31946# Technische Universitaet, Munich (West Germany).
A MORE PRECISE DETERMINATION OF THE NOTCH-FACTOR OF STEEL-BOLTS Ph.D. Thesis
Jueren Schmidt Jul. 1973 154 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $10.75

A contribution for a precise determination of the notch-factor of steel-bolts is presented. An introduction concerning known calculation-methods is followed by the static and dynamic analysis of mechanical properties of the test material. By fatigue tests and by static strain measurements the influence of the side loading on the stress concentration factor at the notch root is determined using threadlike test specimens without thread pitch. To prove the results obtained from experimental tests numerical calculation-and theoretical approximation-methods are used. The transfer of the results gained from the thread-model and the applicability of the theoretical approximation method is checked by predicting the experimentally determined fatigue strength of steel-bolts. By suitable utilization of a diagram, describing the specific fatigue behaviour of the material, the possibility exists to extend the predescribed method to the finite life range of the corresponding SN-curve. Author

N74-31947# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
DESIGNS FOR THE CALIBRATION OF SMALL GROUPS OF STANDARDS IN THE PRESENCE OF DRIFT Final Report
Joseph M. Cameron and Geraldine E. Hailes Aug. 1974 37 p refs
(NBS-TN-844; LC-74-600133) Avail: SOD HC $0.70 as C13.46:844

The process of calibrating a small number of unknown standards relative to one or two reference standards involved determining differences among the group of objects. Drift, due most often to temperature effects, or a left-right polarity effect can bias both the values assigned to the objects and the estimate of the effect of random errors. This note presents schedules of measurements of differences that eliminate the bias from these sources in the assigned value and variances at the same time gives estimates of the magnitude of these extraneous components. The use of these designs in measurement process control is discussed and a computer program in BASIC is presented. Author

N74-31948*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
DESIGN GUIDE FOR HELICOPTER TRANSMISSION SEALS
T. S. Hayden and C. H. Keller, Jr. 10 Sep. 1974 122 p refs Sponsored in part by Army Air Mobility Research and Development Lab.
(Contract NAS3-15684)
(NASA-CR-120997; SER-50791) Avail: NTIS HC $9.25 CSCL 11A

A detailed approach for the selection and design of seals for helicopter transmissions is presented. There are two major types of seals presently being used and they are lip type seals and mechanical type seals. Lip type seals can be divided in conventional lip seals and hydrodynamic lip seals. Conventional lip seals can be used for slow-speed, low-pressure, low-temperature sealing. Hydrodynamic lip seals although they are as pressure and temperature limited as conventional lip seals, can operate at a higher speed. Mechanical types seals are comprised of face seals and circumferential seals. Face seals are capable of high speed, high pressure, and high temperature. Circumferential seals can be used in high-speed and high-temperature applications, but will leak excessively at moderate pressures. The performance goals of transmission seals are a life that is at least equal to the scheduled overhaul interval of the gearbox component and a leakage rate of near zero. Author

N74-31949*# Northeastern Univ., Boston, Mass.
SELECTED RELIABILITY STUDIES FOR THE NERVA PROGRAM Final Report
S. V. Hoover, R. J. Murphy, W. B. Nowak, and R. W. Sexton 31 Jul. 1974 75 p refs
(Grant NGR-22-011-077)
(NASA-CR-139670) Avail: NTIS HC $6.75 CSCL 14D

An investigation was made into certain methods of reliability analysis that are particularly suitable for complex mechanisms or systems in which there are many interactions. The methods developed were intended to assist in the design of such mechanisms, especially for analysis of failure sensitivity to parameter variations and for estimating reliability where extensive and meaningful life testing is not feasible. The system is modeled by a network of interconnected nodes. Each node is a state or mode of operation, or is an input or output node, and the branches are interactions. The network, with its probabilistic and time-dependent paths is also analyzed for reliability and failure modes by a Monte Carlo, computerized simulation of system performance. Author

N74-31950*# Techtran Corp., Glen Burnie, Md.
DIFFUSION WELDING OF STRUCTURAL COMPONENTS FOR AERONAUTICS AND ASTRONAUTICS
K. Gerber Washington NASA Aug. 1974 10 p Transl. into ENGLISH from Raumfahrtforschung (West Germany), v. 18, Jan. - Feb. 1974 p 38-41
(Contract NASw-2485)
(NASA-TT-F-15866) Avail: NTIS HC $4.00 CSCL 13H

Diffusion welding as a modern technique for the fabrication of sandwich structures and integral plates with high thermal and mechanical loads is especially well suited for the requirements of special aerospace products. Results are given of tests with diffusion-welded models made from aluminum, titanium and steel alloys. Finally the fabrication of some structure elements is described. Author

N74-31951*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL EVALUATION OF THE SURFACE DEFORMATION OF ELASTIC SOLIDS SUBJECTED TO A HERTZIAN CONTACT STRESS
Bernard J. Hamrock and Duncan Dowson (Leeds Univ.) Washington Aug. 1974 36 p refs
(NASA-TN-D-7774; E-7964) Avail: NTIS HC $3.25 CSCL 20K

The elastic deformation of two ellipsoidal solids in contact and subjected to Hertzian stress distribution was evaluated

numerically as part of a general study of the elastic deformation of such solids in elastohydrodynamic contacts. In the analysis the contact zone was divided into equal rectangular areas, and it was assumed that a uniform pressure is applied over each rectangular area. The influence of the size of the rectangular area upon accuracy was also studied. The results indicate the distance from the center of the contact at which elastic deformation becomes insignificant. Author

N74-31952# Commissariat a l'Energie Atomique, Grenoble (France).

LEAK-TIGHTNESS PROBLEMS IN SEPARABLE JOINTS USED AT LOW-TEMPERATURES

G. Claudet and J. Verdier Mar. 1972 17 p refs Conf. presented at the spring Meeting of the Mech. Eng. Develop. Group, Paris, 16-18 May 1972

(CEA-Conf-2300; Conf-720574-3) Avail: AEC Depository Libraries HC $3.00

The leak-tightness in joints used at low-temperature is important to be taken in account because the cold parts of cryogenic devices are usually insulated by high vacuum. The problems of leak tightness are in connection with the modification of physical properties of materials by cooling, even mechanical properties (elasticity, ductility, resilience) or thermal properties (expansion, specific heat, conductivity), the latter being of particular importance in transient working conditions. Some examples of solutions given in significant realization are described. Author (NSA)

N74-31953# British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Technical Publications Dept.

A STUDY OF NON-DESTRUCTIVE TESTING OF WELDED SOLAR CELL INTERCONNECTIONS (PHASE 2), 1 FEBRUARY TO 31 MAY 1973

R. M. Jenkins and D. G. Powley Jun. 1973 120 p refs

(Contract ESTEC-1507/71-HP)

(ESS/SS-502; ESRO-CR(P)-304) Avail: NTIS HC $9.00

The results of an investigation concerning the quality of parallel gap resistance welding are presented. The well was used as an inconnection technique for silicon solar cells. Attempts were made to establish the applicability of a number of nondestructive test techniques for in line quality control.

Author (ESRO)

N74-31954# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

PAMIS-EXPERIMENT PROPOSALS FOR SPACELAB. VOLUME 1: NEW PAMIS-EXPERIMENT PROPOSALS FOR SPACELAB

B. Franke Jan. 1974 69 p 3 Vol.

(Contract ESRO-SC/4/73-HQ)

(ESRO-CR(P)-454-Vol-1) Avail: NTIS HC $6.50

The task description, logic and planning of a study to identify and gather experiments for processing and manufacturing in space (PAMIS) is presented. The objectives of the proposed experiments are summarized. ESRO

N74-31955# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

PAMIS-EXPERIMENT PROPOSALS FOR SPACELAB. VOLUME 2: PAMIS-EXPERIMENT REQUIREMENTS

B. Franke and G. Peters Nov. 1973 173 p Original contains color illustrations 3 Vol.

(Contract ESRO-SC/4/73-HQ)

(ESRO-CR(P)-455-Vol-2) Avail: NTIS HC $11.75

The logic, planning and performance of a study to identify experiments for processing and manufacturing in space (PAMIS) is briefly summarized. The results of subcontractors' experiment proposals are given, together with an identification of incompatibility, support equipment required and preliminary cost estimates.

ESRO

N74-31956# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

PAMIS-EXPERIMENT PROPOSALS FOR SPACELAB. APPENDIX: ORIGINAL CONTRIBUTIONS OF CONSULTANTS PAMIS-EXPERIMENT PROPOSALS

Jan. 1974 345 p refs 3 Vol.

(Contract ESRO-SC/4/73-HQ)

(ESRO-CR(P)-456-App) Avail: NTIS HC $20.25

Descriptions of the proposals for experiments in processing and manufacturing in space are given. The proposals include preparation of composite materials; levitation melting of high temperature materials; glass production and crystal growth. Details of the equipment needed are also included. ESRO

N74-31957# SKF Industries, Inc., King of Prussia, Pa. Research Lab.

PROGRESSION OF SURFACE DAMAGE IN ROLLING CONTACT FATIGUE Final Report, May 1973 - Apr. 1974

H. Dalal, G. Cotellesse, F. Morrison, and N. Ninos Feb. 1974 67 p refs

(Contract N00014-73-C-0464; NR Proj. 259-104)

(AD-780453; SKF-AL74T002) Avail: NTIS CSCL 13/9

Deep groove 6309 ball bearings were tested under heavy load in MIL-L-23699 lubricant using an ultraclean closed loop recirculating lubrication system in which the only metallic wearing component was the test bearing. A limited amount of Ferrographic analysis on the oil samples obtained from these tests has not established a definite correlation between Ferrogram readings and bearing failure progression. The discrimination of the Shock Pulse Analyzer (MEPA) to differentiate between a failed and non-failed bearing was confirmed. The shock value increased from 500 or less on a running bearing to 1000 or more on a failed bearing. (Modified author abstract) GRA

N74-31958# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.

A STUDY OF WEAR REACTIONS IN A HIGH SPEED TEST BETWEEN A NICKEL AND A NICKEL-30 WEIGHT PERCENT CHROMIUM SPECIMEN

Michael S. Beaton Feb. 1974 72 p refs

(Contract N00014-68-A-0144)

(AD-780458; ME-74-T57-18) Avail: NTIS

The study includes systematic surveys of the nickel and Ni-30 Cr wear surfaces using scanning electron microscopy (SEM). Nondispersive X-ray analysis was used in conjunction with SEM to determine the qualitative chemical compositions of various features on the wear surfaces. Optical microscopy was used to examine metallographic samples of the wear track cross-section, and to preview the specimens for location of areas of particular interest. GRA

N74-31959# Aluminum Co. of America, Alcoa Center, Pa.

PROGRAM TO DEVELOP HIGH STRENGTH ALUMINUM POWDER METALLURGY PRODUCTS PHASE 4: SCALE UP TO 3200 POUND BILLETS Quarterly Report, 20 Sep. - 19 Dec. 1973

W. S. Cebulak 26 Apr. 1974 23 p refs

(Contract DAAA25-72-C-0593)

(AD-780455; QR-6) Avail: NTIS CSCL 13/8

Preheating with Ar or no gas flow followed by evacuation and vacuum hot pressing gave P/M wrought products with high fracture toughness only when the vacuum can temperature was maintained above 800F. Vacuum preheating and vacuum hot pressing imparted high toughness in P/M wrought products for can temperatures from 600F to 820F. MA87 extrusions from compacts preheated below the alloy solidus gave higher transverse fracture toughness than earlier extrusions preheated above the solidus temperature. GRA

N74-31960# Pennsylvania State Univ., University Park. Dept. of Industrial Engineering.

ELEVATED TEMPERATURE MACHINING OF HIGH STRENGTH ALLOYS

Alfred O. Schmidt Mar. 1974 39 p refs

(Contract DAAF01-70-C-0686)

(AD-780034; RIA-R-TR-74-011) Avail: NTIS CSCL 13/8

Hot-machining tests in turning, boring, and milling were conducted on AISI 4340, AISI 4150, and on manganese steel workpieces to improve the shaping of both conventional and difficult-to-machine alloys. The workpieces were heated during the machining operations by one of three methods, namely a sliding electrode, a TIG torch, and friction elements. Test tool materials were of various types of ceramics, tungsten-titanium carbides, titanium carbides, and titanium-coated carbides. Cutting

force measurements were made with a three-component dynamometer. (Modified author abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-31961*# Alabama Univ., University. Dept. of Electrical Engineering.
THRESHOLD DETECTION IN AN ON-OFF BINARY COMMUNICATIONS CHANNEL WITH ATMOSPHERIC SCINTILLATION Interim Report
William E. Webb and Joseph T. Marino, Jr. May 1974 18 p refs
(Contract NAS8-25562)
(NASA-CR-12041; BER-172-70) Avail: NTIS HC $4.00 CSCL 20E

The optimum detection threshold in an on-off binary optical communications system operating in the presence of atmospheric turbulence was investigated assuming a poisson detection process and log normal scintillation. The dependence of the probability of bit error on log amplitude variance and received signal strength was analyzed and semi-emperical relationships to predict the optimum detection threshold derived. On the basis of this analysis a piecewise linear model for an adaptive threshold detection system is presented. Bit error probabilities for non-optimum threshold detection system were also investigated. Author

N74-31962*# Wesleyan Univ., Middletown, Conn. Dept. of Physics.
LASER RANGING GROUND STATION DEVELOPMENT Final Report, Apr. 1970 - Sep. 1973
James E. Faller Sep. 1973 9 p
(Grant NGR-07-006-008)
(NASA-CR-139586) Avail: NTIS HC $4.00 CSCL 20E

The employment of ground to conduct radar range measurements of the lunar distance is discussed. The advantages of additional ground stations for this purpose are analyzed. The goals which are desirable for any new type of ranging station are: (1) full time availability of the station for laser ranging, (2) optimization for signal strength, (3) automation to the greatest extent possible, (4) the capability for blind pointing, (5) reasonable initial and modest operational costs, and (6) transportability to enhance the value of the station for geophysical purposes. Author

N74-31963*# Techtran Corp., Glen Burnie, Md.
QUANTITATIVE ANALYSIS OF VARIOUS MATERIALS BY LASER-MICROSPECTROSCOPY
H. Schroth Washington NASA Aug. 1974 16 p refs Transl. into ENGLISH from Z. Anal. Chem. (East Germany), v. 261, no. 1, 1972 p 21-29
(Contract NASw-2485)
(NASA-TT-F-15891) Avail: NTIS HC $4.00 CSCL 20E

For investigating the possibilities of quantitative laser microspectroscopy in alloys and in oxidic and sulfidic materials, tests were carried out with a normal and a Q-switched laser. Calibration curves were determined for the elements: Mg, Al, Ni, Cu, Mo and Ag. Using the relative standard deviation it could be demonstrated, that the determinations obtained with Q-switched laser have more accuracy due to the smaller slope of the calibration curves. Moreover it was ascertained that the reflectivity of metallic samples heavily influences the results obtained with Q-switched and normal laser. Sample inhomogeneities observable microscopically within certain limits only impair the accuracy of the determination, however not making analyses impossible. Author

N74-31964# Los Alamos Scientific Lab., N.Mex.
METAL ATOM OXIDATION LASERS
W. W. Rice, W. H. Beattie, J. G. Dekoker, D. B. Fradkin, P. F. Bird, and R. J. Jensen Mar. 1974 99 p refs
(Contract W-7405-eng-36)
(LA-5452) Avail: NTIS HC $5.45

Exploding wire and film techniques for metal atom production have been extraordinarily successful in producing laser action from exothermic exchange reactions of the form M + XY yields MX* + Y. To date, lasing has been observed from CO, TiO, VO, ZrO, MoO, TaO, WO, UO, LiF, CF, MgF, AlF, TiF, VF, FeF, NiF, CuF, ZnF, ZrF, MoF, AgF, TaF, WF, PtF, AuF, and UF molecules in the IR region of the spectrum. Explosively shocked metal structures have been used to provide jets of metal atoms that have also produced lasing from MgF. This result corroborates the assertion that the lasing from the exploding wire event is chemical in origin, and it provides an alternative technique for possible future development. It was possible to operate a sodium nozzle into a flow of fluorine gas for 40 min using a high-thermal-conductivity structure to supply sodium vapor to the nozzle plenum. Author (NSA)

N74-31965# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
APPLICATION OF PULSED HOLOGRAPHY FOR THE INVESTIGATION OF DYNAMIC PARTICLE FIELDS
Hans-Dieter Gabler 31 Oct. 1973 41 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-34) Avail: NTIS HC $5.25; DFVLR, Porz, West Ger. 17 DM

A description of the possibilities of recording and analysing pulsed holograms of dynamic particle-fields is given. The range- and error-limitations of velocity, spatial location, density and size of the particles are considered. The pulsed ruby-lasers used and the experiments to test their applicability for recording pulsed holograms are described. Author (ESRO)

N74-31966# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
HIGH POWER SMALL DIMENSION CO2 LASERS [HOCHLEISTUNGS-CO2-LASER MIT GERINGEM BAUVOLUMEN]
Hartmut Engel Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1974 55 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-74-04) Avail: NTIS HC $5.75; ZLDI, Munich 11,15 DM

A concept has been developed for a carbon dioxide laser with high power per unit length or volume based on the transverse-flow principle with convection cooling and transverse discharge. The design and construction of a laser module which can be used as a building block for larger units is described. The operating parameters of the module have been evaluated and optimized to a 20-fold increase in power over conventionally built carbon dioxide lasers. Specific powers of 1.2 to 1.5 kilowatts per meter discharge length were measured in multimode operation. Author (ESRO)

N74-31967# Bendix Research Labs., Southfield, Mich.
FEASIBILITY STUDY OF EXOELECTRON IMAGING AS AN NDT METHOD FOR LASER SURFACE DAMAGE OF NONLINEAR OPTICAL MATERIALS AND LASER GLASS Semiannual Technical Report, Mar. - Sep. 1973
Peter F. Braunlich and John P. Carrico Sep. 1973 83 p refs
(Contract F19628-73-C-0032; ARPA Order 2042)
(AD-779799; BRL-7058; AFCRL-TR-73-0591; SATR-2) Avail: NTIS CSCL 20/5

The semi-annual report presents the results of a second six-month effort on the development of an NDT method to predict laser surface damage on dielectric materials used in high power laser systems. Experimental results on thermally and/or optically stimulated exoelectron emission from Nd-2 laser glass, and NaCl and LiNbO3 single crystals after electron bombardment or exposure to high peak power laser pulses are given. Computer calculations of the spatial variation of the density of trapped electrons after exposure of a pure NaCl single crystal to a high peak power pulse of a TEM(00) mode laser beam are reported and discussed. Experiments on exoelectron images from LiF surfaces are interpreted on the basis of these results. The role of a white-hot plasma in front of the examined LiF surface is described. New information on multiphoton free carrier generation, on free carrier absorption, and on their involvement in the exoelectron processes and in the surface damage mechanisms was obtained. Author (GRA)

N74-31968# Naval Research Lab., Washington, D.C.
TOWARDS SHORTER WAVELENGTH LASERS AND BREAKING THE 1000 A BARRIER 1 (ELECTRON AND PHOTON PUMPING) Interim Report
A. W. Ali May 1974 40 p refs Submitted for publication
(AD-779838; NRL-MR-2792) Avail: NTIS CSCL 20/5

In the report electron and photon pumping as excitation mechanisms for vacuum ultraviolet (VUV) and X-ray lasers are discussed. Criteria are developed and quantitative estimates of the required pump powers are given. The necessary tools for model calculations are presented and some possible short wave laser sources are pointed out. Author (GRA)

N74-31969# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 14, OCTOBER - DECEMBER 1973
Stuart G. Hibben 30 Apr. 1974 123 p refs
(Contract F4460-72-C-0053)
(AD-779940; AFOSR-74-0796TR) Avail: NTIS CSCL 20/5

This is the Soviet Laser Bibliography for the fourth quarter of 1973 and is No. 14 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; computer technology; holography; laser-induced chemical reactions; instrumentation and measurements; beam-target interaction; and plasma generation and diagnostics.
Author (GRA)

N74-31970# General Research Corp., Arlington, Va.
SPACE OBJECT LASER ANALYSIS (SOLA) Final Technical Report, 1 Oct. 1972 - 30 Sep. 1973
M. Horrocks, E. Chang, A. Eckert, G. Gurski, and F. Sevick Feb. 1974 210 p refs
(Contract F30602-73-C-0039; AF Proj. 6527)
(AD-779854; GRC-CR-1-351; RADC-TR-73-413) Avail: NTIS CSCL 17/8

The space object laser analysis (SOLA) provided analytic support to the CORAL (Coherent Optical Radar Laboratory) activities at Rome Air Development Center. The primary effort reported here was performed during the final half of the contract period and is concentrated on the signal processing and data management aspects of space object identification and analysis with a coherent laser radar system. Laser hardware system formats and the relationship and potential use of microwave radars are also discussed. Author (GRA)

N74-31971# Catholic Univ. of America, Washington, D.C. Dept. of Chemistry.
INFRA-RED LASERS AND INFRA-RED SPECTRA OF FREE RADICALS Annual Report
F. X. Powell 23 Apr. 1974 23 p refs
(Contract N00014-67-A-0377-0010)
(AD-779916) Avail: NTIS CSCL 20/5

The reaction of NO with active nitrogen produces excited species which can transfer energy to CO2 yielding laser lines at 10.6 micrometers. It has been demonstrated that the reaction of N atoms with NO yields N2 in a vibrationally excited state. It has also been demonstrated that the discharge parameters are critical and that different discharges produce species which can energize the laser in various ways. Author (GRA)

N74-31972# TRW Systems Group, Redondo Beach, Calif.
H2-Cl2 CHEMICAL LASER PROGRAM. PART 1: CHEMLUM CODE FOR SPECTROSCOPIC DATA ANALYSIS Final Report, Dec. 1972 - Dec. 1973
J. T. Latimore, A. M. Takemoto, R. A. Ackerman, W. L. Shackleford, and G. Emanuel Jan. 1974 51 p
(Contract DAAH01-73-C-0446)
(AD-780178; RK-74-9-Pt-1) Avail: NTIS CSCL 07/4

A new computer code is described that analyzes data obtained from spectroscopic measurements of chemiluminescent emission. Primary input to the code is digitized spectrometer signal data of the vibrational-rotational emission spectra of HCl, HF or DF molecules. The code computes the rotational temperature, vibrational number densities, and line-by-line gains of the excited species. This report presents the theoretical basis and numerical formulation for the code, and operational procedures for its use. A sample case is included. Author (GRA)

N74-31973# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE HYDROGEN DISSOCIATION LASER Physical Sciences Research Papers
Arthur Cohn, Allen G. Rubin, and Arthur L. Besse 5 Apr. 1974 14 p refs
(AD-780622; AFCRL-TR-74-0110; AFCRL-PSRP-592) Avail: NTIS CSCL 20/5

The H2 dissociation laser buffered with argon using electron beam excitation is considered. The argon buffer greatly increases the light output from the upper laser level, compared with pure hydrogen. It does this by absorbing much more of the electron beam energy, and by transferring it more efficiently to the upper laser level. Upper laser level densities of 3 x 10 to the 13th power per cc are experimentally obtained. This should be sufficient for practical gain if auxiliary loss processes such as photoionization absorption do not cancel the gain. This problem has not yet been determined. If these adsorption processes are within estimated bounds, an energy density of approximately 5 joules per liter, over a pulse time of about 10 nsec, at an efficiency of about 10 percent for tunable radiation in the 0.4- to 0.6-micrometer wavelength range is predicted. Author (GRA)

N74-31974# Army Foreign Science and Technology Center, Charlottesville, Va.
RADIATION FIELD STRUCTURE DURING SYNCHRONIZATION OF TRANSVERSE MODES IN A LASER
E. S. Kovalenko and G. G. Kushch 20 Mar. 1974 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 2, 1973 p 156-158
(AD-781156; FSTC-HT-23-1846-73) Avail: NTIS CSCL 20/5

Since synchronization of transverse oscillations of a laser can result in scanning of output radiation, the distribution of amplitudes and phases of transverse modes of laser oscillations was analyzed to correspond closely to conditions in real lasers. It was found that as the synchronized transverse modes increase in number, the modulation of the laser output radiation rises sharply. Author (GRA)

N74-31975# Harry Diamond Labs., Washington, D.C.
STUDIES RELATIVE TO POSSIBLE LASER PUMPED BY NUCLEAR BETA RAYS. 2: POWER AND SHIELDING REQUIREMENTS
Clyde A. Morrison and Donald E. Wortman Jan. 1974 44 p refs
(AD-780728; HDL-TR-1647) Avail: NTIS CSCL 20/5

An investigation has been made of problems that would be encountered in providing for and using the nuclear power from the beta decay of Tm170 to pump a rare-earth ion laser. The Tm170 is to be created by bombarding LiTmF4 containing stable Tm169 by thermal neutrons. The rare earth impurity ion selected for the laser will substitute for a small amount of the thulium. It was found that exposing the LiTmF4 crystal to a thermal neutron flux of 10 to the 14th power/sq cm-sec for 3 days could create a power density within LiTmF4 comparable with that of a 100-W xenon lamp used for optically pumping Ho(3+). The energy level of escaping radiation is low enough so that shielding to insure safe handling without compromising portability can be provided with no great difficulty. Range calculations showed, for example, that the range of 1-MeV electrons in liquid nitrogen is only about 0.5 cm. Low-Z material can be used for shielding the beta rays because of the lower intensity bremsstrahlung that would be created thereby. (Modified author abstract) GRA

N74-31976# Aerospace Corp., El Segundo, Calif.
THE FRESNEL DIFFRACTION PATTERN OF A CIRCULAR APERTURE AT LARGE DISTANCES Technical Report, Apr. - Nov. 1973
M. T. Tavis and N. C. Chang 15 Mar. 1974 65 p refs
(Contract F04701-73-C-0074)
(AD-781129; TR-0074(4010-01)-1; SAMSO-TR-74-139) Avail: NTIS CSCL 20/6

A technique for evaluation of the Fresnel diffraction pattern

of a circular aperture with obscuration is discussed. The analysis considers Gaussian illumination over the aperture with constant illumination as the limiting case of infinite beam width. A lens correction factor is also applied. Examples of the pattern in the near region and Rayleigh region are given. Examples with lenses with positive and negative focal lengths are also given. All numerical cases considered are for constant illumination. A computer program for the calculation is given in the Appendix. An Addendum comparing these results with the results of another author has been included. Author (GRA)

N74-31977# California Univ., Livermore. Lawrence Livermore Lab.
POSSIBILITY OF A HIGH ENERGY STORAGE VISIBLE LASER ON THE AURORAL LINE OF OXYGEN
J. R. Murray and C. K. Rhodes 12 Sep. 1973 43 p refs
(Contract W-7405-eng-48)
(UCRL-51455) Avail: NTIS HC $4.00

The auroral line of oxygen at 5577 A has properties which may make it useful for a high energy storage, short pulse, visible gas laser. Reactions and kinetics which would affect the operation of an auroral line laser are reviewed. A kinetic model of a possible laser using photolytic decomposition of N2O by krypton excimer radiation is described. Other possible excitation mechanisms are discussed. Author

N74-31978# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICS RESEARCH: 1973:2 Semiannual Report, 1 Jul. - 31 Dec. 1973
Robert H. Rediker 31 Dec. 1973 75 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-779917; ESD-TR-74-17) Avail: NTIS CSCL 20/5

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 July through 31 December 1973. The topics covered are laser technology and propagation and optical measurements and instrumentation. (Modified author abstract) GRA

N74-31979# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MUTUAL COHERENCE FUNCTION AND FREQUENCY SPECTRUM OF A LASER BEAM PROPAGATING THROUGH ATMOSPHERIC TURBULENCE Physical Sciences Research Papers
Ronald L. Fante 6 Feb. 1974 39 p refs
(AF Proj. 5635)
(AD-781039; AFCRL-PSRP-585; AFCRL-TR-74-0079) Avail: NTIS CSCL 20/6

The mutual coherence function of a laser beam propagating in turbulence with a modified von Karman spectrum for the index of refraction fluctuations, including a parametric study of the effect on the MCF of varying beam size, focal length, and the properties of the turbulence was computed. The results are valid over all propagation distances, unlike calculations employing the method of smooth perturbations. Also studied was the effect of a constant wind on the frequency spectrum of signal. It was found that over most practical path lengths the spectral width is delta omega = 4.1V ((k sub o)sup 6/5)(z sup 3/5)((C sub n,sub 2)sup 3/5), where V is the wind speed, k sub o is the signal wavenumber, C sub n sup 2 is the strength of turbulence, and z is the path length in the turbulence. (Modified author abstract) GRA

N74-31980# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PRESSURE PRODUCED BY VAPORIZATION AS A MECHANISM FOR REMOVING MELT FROM A TARGET SUBJECTED TO LASER RADIATION M.S. Thesis
Martin M. Bittner Mar. 1974 139 p refs
(AD-780631; GAW/MC/74-11) Avail: NTIS CSCL 20/5

An analysis was made of the effect of pressure generated by vaporization of the surface of a thin slab irradiated with a high intensity laser beam. A finite element analysis was used to obtain numerical solutions of the heat and flow equations, and a computer program was developed to perform the required calculations. Titanium and aluminum slabs 0.08 and 0.127 cm thick were analyzed for response to pressure effects using peak absorbed intensities of 10,000 to 140,000 watts/sq cm. Pressures in the low pressure regime were predicted by the model, and the model predicted that melt removal afrom the area of flux incidence occurred. The most significant effect was a reduction in time required to melt the rear surface of the slab over the time computed on a strictly two dimensional heat flow analysis. Slab thickness, material properties, and peak absorbed intensities all contributed to the overall effect. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-31981 British Library Lending Div., Boston Spa (England).
CORROSION TESTS ON WELDED SHEETS OF INCOLOY 800 IN SUPERHEATED STEAM
S. Leistikov et al 28 Feb. 1974 17 p refs Transl. into ENGLISH from Werkst. Korros. (West Germany), v. 24, no. 4, Apr. 1973 p 269-273
(BLL-CE-Trans-6311-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The properties of materials in welded joints are discussed with respect to the corrosion tendencies. Electron beam welding results in a very narrow fusion zone and heat affected zones and can be carried out without the use of filler material. The formation of a coarse grained solidified structure in the weld and the effect on the corrosion reaction are examined. The corrosion behavior in superheated steam of electron beam welds was tested on specimens of Incoloy 800. The possibilities of increasing resistance of the welds to corrosion by applying cold-work treatment to the surface are considered. Author

N74-31982# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
REDUCING SURFACE HOT SHORTNESS OF COPPER-CONTAINING STEELS USING SILICON ADDITIONS AND CONTROLLED REHEATING CONDITIONS
Mark I. Copeland 1974 23 p refs
(BM-RI-7936) Avail: NTIS HC $4.25

This study was conducted by the Bureau of Mines to determine the effect of steel reheating practices in burning natural gas on the amount of silicon required to prevent the formation of copper on steels containing up to 1 wt-pct Cu. Formation of copper, which causes surface hot shortness, was readily prevented by as little as 0.3 wt-pct Si and by 2 vol-pct excess oxygen in the furnace atmosphere when reheating steels containing up to 0.8 wt-pct Cu. Up to 0.8 wt-pct Si content and careful control of reheating conditions were necessary for steels containing 1 wt-pct Cu. Best conditions for these steels were reheating to 2,200 F (1,205 C) in burning gases containing 2 vol-pct excess oxygen, and then to higher temperatures in gases of 6 vol-pct excess oxygen. Slag and mold wash were not detrimental on steels reheated for 8 hr by a soaking-pit-type furnace schedule, but they were problematical on steels heated for 2 hr by a pusher-type furnace schedule. The effect of silicon contents on scaling rates also was determined. Author

N74-31983# National Aeronautical Lab., Bangalore (India).
DISPERSION HARDENED TITANIUM ALLOYS BY POWDER METALLURGY
S. Pattanaik, K. G. Gopinathan, and V. S. Arunachalam Mar. 1974 29 p refs
(NAL-TN-45) Avail: NTIS HC $4.50

The characteristics and applications of titanium alloys for structural purposes are discussed. A method of producing dispersion hardened titanium alloys through powder metallurgical techniques is described. An electron beam splatting furnace designed for producing titanium flakes and a comminutor for mechanically alloying the flakes are described. Results on titanium-yttria and titanium-ceria are presented to show the efficacy of dispersion hardening. It is suggested that in general high temperature creep of dispersion hardened materials depends

only on dispersion parameters and not on the associated temperature. Author

N74-31984*# Nebraska Univ., Lincoln. Dept. of Mechanical Engineering.
HYDROGEN TRANSPORT IN ALPHA TITANIUM Annual Progress Report
Donald L. Johnson and Kirit K. Shah 25 Aug. 1974 20 p refs
(Grant NGR-28-004-025)
(NASA-CR-139632) Avail: NTIS HC $4.00 CSCL 11F

Permeation experiments after nitriding the inlet surface of a hollow cylindrical membrane were conducted. Permeation data on two additional specimens given pre-oxidation or pre-nitriding treatments at both inlet and outlet surfaces are presented in terms of Arrhenius plots. Additionally, an analysis of geometry dependence on permeation rate was made for several specimens including the ones mentioned above. For simplicity in this report, the term as-polished is used to refer to a specimen which is either as-polished or is as-polished, pre-oxidized and annealed. Author

N74-31985*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF COMPOSITION AND TESTING CONDITIONS ON OXIDATION BEHAVIOR OF FOUR CAST COMMERCIAL NICKEL-BASE SUPERALLOYS
Carl E. Lowell and Hubert B. Probst Washington Aug. 1974 30 p refs
(NASA-TN-D-7705; E-7916) Avail: NTIS HC $3.25 CSCL 11F

Four cast nickel-base superalloys were oxidized at 1000 and 1100 C for times up to 100 hr in static air and a Mach 1 gas stream. The oxidation resistance was judged by weight change, metal thickness loss, depletion-zone formation, and oxide formation and morphology. The alloys which formed mostly nickel aluminate ($NiAl_2O_4$) and aluminum oxide (Al_2O_3) (B-1900, VIA, and to a lesser extent 713C) were more oxidation resistant. Poorer oxidation resistance was associated with the appearance of chromium sesquioxide (Cr_2O_3) and chromite spinel (738X). Refractorymetal content had little effect on oxidation resistance. Refractory metals appeared in the scale as tapiolite (NiM_2O_6, where M represents the refractory metal). Thermal cycling in static air appeared to supply sufficient data for the evaluation of oxidation resistance, especially for alloys which form oxides of low volatility. For alloys of higher chromium levels with high propensities toward forming a chromium-bearing scale of higher volatility, testing under conditions of high gas velocity is necessary to assess fully the behavior of the alloy. Author

N74-31986*# Kanner (Leo) Associates, Redwood City, Calif.
INTENSITY RATIO OF PRINCIPAL-SERIES DOUBLETS OF THE ALKALI METALS
H. Jakob Washington NASA Aug. 1970 50 p refs Transl. into ENGLISH from Ann. Phys. (Leipzig), v. 86, no. 12, 1928 p 449-493
(Contract NASw-2481)
(NASA-TT-F-15892) Avail: NTIS HC $5.50 CSCL 11F

The intensity ratios between the components of the second principal-series doublets of potassium, rubidium and cesium are measured as functions of vapor density in an oxyhydrogen flame, using a photographic/photometric method. Values between 1.80 and 2.02 are found for K. Merton's grid method of evaluating photographs is modified. Line absorption is measured by Gouy's method for the second principal-series terms of rubidium and cesium to obtain intensity-ratio limits. A value of 4.0 is approached by cesium. A suitable value was not obtained for rubidium, but it is concluded to be greater than 2.3. Author

N74-31987*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
THE EFFECT OF MICROSTRUCTURE AND STRENGTH ON THE FRACTURE TOUGHNESS OF AN 18 Ni, 300 GRADE MARAGING STEEL
J. A. Psioda and J. R. Low, Jr. Aug. 1974 50 p refs
(Grant NGR-39-087-003)
(NASA-CR-139673; TR-6) Avail: NTIS HC $5.50 CSCL 11F

Methods for increasing the strength of maraging steels are discussed. An investigation was conducted to systematically vary the strength of 18 weight percent nickel, 300 grade maraging steel, to isolate any attending microstructural changes, and to study the effects of these changes on the fracture toughness of the alloy. A study aimed at determining the aging behavior of the program alloy was carried out to provide data by which to estimate yield strength. The effects of various alloying materials on the strength of the maraging steel are examined. The mechanical properties of the 300 grade maraging steel were determined by tension tests, fatigue precracked Charpy impact tests, and plane strain fracture toughness tests. Author

N74-31988# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
EFFECTS OF MICROSTRUCTURAL MODIFICATIONS ON TITANIUM TOUGHNESS AND FATIGUE
James Kennedy Aug. 1974 12 p refs
(RM-590) Avail: NTIS HC $4.00

Some effects of microstructure and chemical composition on the toughness and fatigue characteristics of titanium alloys after various heat treatments are described. This work is part of a program to determine quantitatively the cumulative effects of titanium microstructure, chemistry, and texture on plastic deformation and mechanical behavior. The present studies were conducted on Ti-6Al-4V and Ti-6Al-6V-2Sn plate and forging in the mill annealed and recrystallized annealed conditions. It was generally observed that fracture toughness was improved by recrystallization annealing heat treatments and that lower alpha stabilizing contents and grain coarsening were associated with higher fracture toughness values. A similar trend for fatigue crack growth resistance was also noted. The results indicate that fatigue crack growth for these materials may have increased sensitivity to differences in microstructure and chemistry at low stress intensities during fatigue loading. Author

N74-31989# California Univ., Berkeley. Lawrence Berkeley Lab.
UNTEMPERED ULTRA HIGH STRENGTH STEELS OF HIGH FRACTURE TOUGHNESS Final Report, 16 Mar. 1973 - 15 Mar. 1974
E. R. Parker, V. F. Zackay, G. Y. Lai, and R. M. Horn Apr. 1974 78 p refs
(Contract DAAG46-73-C-0120; DA Proj. 1T1-61101-A-91A) (AD-780017; LBL-2715; AMMRC-CTR-74-33) Avail: NTIS CSCL 11/6

The objective of the present investigation was to establish, in high yield strength steels, relationships between microstructure, fracture toughness and fatigue crack growth. Extensive microstructural examination and characterization were conducted on as-quenched, and quenched and tempered AISI 4340 steel which was austenitized both at the conventional (870C) and the high (1200C) austenitizing temperatures. Changes in fracture toughness resulting from variations in austenitizing and tempering treatments were related to changes in the amount and distribution of retained austenite, the morphology and distribution of carbides, and the martensite substructure and morphology. The influence of microstructure on fatigue crack propagation was investigated in as-quenched, and quenched and tempered 5Mo-0.3C secondary hardening steel. (Modified author abstract) GRA

N74-31990# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforshung.
STRESS-RUPTURE BEHAVIOR OF TUBES OF AUSTENITIC STEELS AND NICKEL-BASE ALLOYS UNDER INTERNAL PRESSURE
F. Polifka, L. Schaefer, and H. Kempe Nov. 1973 95 p refs In GERMAN; ENGLISH summary
(KFK-1882) Avail: AEC Depository Libraries HC $6.75

The results of stress-rupture tests on tubes of seven austenitic stainless steels and five Ni-based alloys, part of which had undergone different thermo-mechanical treatments, are reported. The tubes were loaded by internal gas pressure causing a biaxial stress state. The test temperatures were 600 to 750C. The thin walled seamless precision tubes were carefully checked before in order to detect defects and dimensional variations. The outer diameter was about 6mm. Plots of stress-rupture curves, of master curves according to Larson and Miller, of strain-at-

fracture curves in dependence of rupture-life are presented in addition to metallographic pictures of the fracture area and different tables. A short description of the experimental procedures is given. The calculation of the stresses in the tube and a comparison with stress-rupture tests in uniaxial state of stress are described. NSA

N74-31991# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
STUDIES OF MICROSTRUCTURE PROPERTY RELATIONSHIPS IN AUSTENITIC STAINLESS STEEL Progress Report, 1 Jan. - 31 Dec. 1973
J. E. Spruiell 1973 60 p refs
(Contract AT(40-1)-4044)
(ORO-4044-4) Avail: NTIS HC $5.00

Research progress is reported on microstructural stability of thermal-mechanically pretreated 316 stainless steel, precipitation behavior in 321 stainless steel, stability of 316 stainless steel weldments, and characteristics of cold worked stainless steels. NSA

N74-31992# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
LOW TEMPERATURE BRITTLENESS
D. F. Stein 1973 33 p refs Presented at 3d Intern. Conf. on Strength of Metals and Alloys, Cambridge, England, 20-25 Aug. 1973 Sponsored by AEC
(COO-2166-12; Conf-730806-5) Avail: NTIS HC $3.75

Calculations to estimate the drag stress due to inherent lattice resistance and defect interactions are well developed and useful. Limitations, however, exist in the understanding of the rate of dislocation multiplication and in the sensitivity of dislocation motion to stress and since these appear to be important in determining the fracture behavior, full understanding will await determination of the origin of these parameters. Understanding of certain aspects of grain boundary fracture of materials is proceeding rapidly, primarily because of the development of new analytical tools for determining grain boundary chemistry. It is now possible to determine the chemistry within an atom layer of the grain boundary so the chemical composition of the fracture path can be accurately determined. However, the basic problem of predicting the fracture behavior is the same as that for cleavage. Data are given for the metals Mo, V, Ta, Nb, and W. Author (NSA)

N74-31993# Rensselaer Polytechnic Inst., Troy, N.Y.
PRECIPITATION AND DISPERSION HARDENING IN MAGNESIUM-BASE ALLOYS Annual Report
N. S. Stoloff 2 Jan. 1974 22 p refs
(Contract AT(11-1)-3459)
(COO-3459-5) Avail: NTIS HC $3.25

Activities in a program on the elevated temperature mechanical properties of a directionally solidified Mg-Al eutectic composite are summarized along with results of an investigation of fatigue in vanadium. The lamellar Mg-Al eutectic, consisting of a brittle Mg17Al12 matrix phase and an Mg-Al eutectic, consisting of a brittle Mg17Al12 matrix phase and an Mg-8%Al solid solution, undergoes a sharp transition from brittle to ductile fracture at 250 C. A peak in strength in both tension and compression is noted as a function of growth speed. This peak is attributed to a change in fault density of the eutectic with growth speed. The influence of temperature on the properties of the composite is shown to arise primarily from changes in the resistance to plastic flow of the Mg17Al12 intermetallic phase. The program to study fatigue in vanadium has consisted of design of an environmental chamber for vacuum heat treating, or hydrogen charging, heat treatments to develop a 60-micron grain size, and fatigue specimen and grip design. Preliminary high cycle fatigue data in tension-tension loading, generated at room temperature, indicate a sharp endurance limit for unalloyed vanadium near a peak stress of 32,000 psi. Author (NSA)

N74-31994# California Univ., Berkeley. Lawrence Berkeley Lab.
INFLUENCE OF HEAT TREATMENT ON THE FATIGUE CRACK GROWTH RATES OF A SECONDARY HARDENING STEEL M.S. Thesis
R. M. Horn Dec. 1973 110 p refs
(Contract W-7405-eng-48)
(LBL-2292) Avail: NTIS HC $7.50

The relationships between microstructure and fatigue crack growth properties in a 5% Mo-0.3% C steel were studied. Microstructural differences were achieved by varying austenitizing temperature and tempering treatment. These variations in treatment changed the amounts and distribution of carbides, the prior austenite grain size, and the composition of the as-quenched matrix. Optical metallography and scanning electron microscopy were used to characterize and identify the microstructures. For each heat treatment, the fatigue crack growth properties were measured under plane-strain conditions using a compact tension specimen. Fatigue crack growth rates, measured under constant tension-tension load conditions, are reported using the empirical relation of Paris. Significant differences in crack growth behavior were found with different microstructures. It was found that microstructural features affecting fracture toughness did not always affect fatigue crack propagation in the same way. Author (NSA)

N74-31995# Oak Ridge National Lab., Tenn.
AUGER ELECTRON SPECTROSCOPY OF FRACTURE SURFACES IN IRRADIATED TYPE 304 STAINLESS STEEL
E. E. Bloom and R. E. Clausing Mar. 1974 22 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4495) Avail: NTIS HC $3.25

Surfaces were studied in type 304 stainless steel fractured after irradiation at 370 C. The irradiated samples failed primarily along grain boundaries, although in some cases areas of ductile transgranular fracture were also present. He release during fracture was monitored with a residual gas analyzer; its concentration at the boundaries was approximately proportional to the fast neutron fluence to which the samples were irradiated, being about 0.08 helium atoms per grain boundary site at 1 x 10 to the 23rd power n/sq cm. Phosphorus was more concentrated at grain boundaries than on ductile fracture surfaces. Sulfur segregated to surfaces during and after the fracture, suggesting that it could segregate to grain boundaries. Grain boundary fracture surfaces of irradiated samples were depleted in Cr and enriched in Fe and Ni compared with ductile fractures of unirradiated samples broken at the same temperature. Author (NSA)

N74-31996# Oak Ridge National Lab., Tenn.
ROOM TEMPERATURE CHARACTERIZATION DATA OR TYPE 304 STAINLESS STEEL (HEAT 9T2796) PLATE
R. W. Swindeman Feb. 1974 29 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4396) Avail: NTIS HC $4.00

One-inch plate obtained from a reference heat of type 304 stainless steel was characterized at room temperature. This characterization consisted of composition, microstructure, and mechanical property evaluations relative to data available for other heats of type 304 stainless steel. The influence of laboratory reannealing was also examined. The composition was fairly typical except for below average carbon and nitrogen levels. The microstructure was also examined. The composition was fairly typical except for below average carbon and nitrogen levels. The microstructure was fairly free of inclusions, and the grain size was coarse. The yield strength was near the 30,000 psi minimum specified for type 304 stainless steel conforming to ASTM specification A 240 and below the minimum in the reannealed condition. Possibly this was due to the coarse grain size in combination with low interstitial element content. Little, if any, differences were observed between specimens reannealed in the 1800 to 2000 F range. Author (NSA)

N74-31997# Oak Ridge National Lab., Tenn.
FORMATION AND USE OF OXIDE FILMS TO IMPEDE OUTGASSING OF METALS
R. A. Strehlow and H. C. Savage 1973 12 p refs Presented at the Surface Effects in Controlled Thermonucl. Fusion Devices and Reactors Meeting, Argonne, Ill., 10 Jan. 1974 Sponsored by AEC
(Conf-740104-5) Avail: NTIS HC $3.00

Phenomena associated with the outgassing of metals are generally interpreted using models based either on desorption of compounds from the surface or on diffusion of dissolved

gases from the interior of the metal. It is generally recognized that surface oxide films can serve to decrease outgassing rates of metals. However, the processes associated with the outgassing of oxidized or oxide-coated metals are not well understood. Outgassing of oxidized metals is considered in light of the results of recent studies of hydrogen permeation through metals with well characterized oxide films. The chemical stabilities of the oxides as well as the physical imperfections of the film are considered. A model is suggested for the expected outgassing behavior of oxidized steels at intermediate temperatures, which are of interest in the design of controlled thermonuclear research experiments and reactors. The role of impurities and the usefulness of specialized oxidation treatments are discussed. Author (NSA)

N74-31998# Sandia Labs., Albuquerque, N.Mex.
EVALUATION OF THREE COMMERCIAL-GRADE NICKEL ALLOYS FOR ELECTRICAL CONTACTS IN A DECELERATION SWITCH
R. E. Cuthrell and D. W. Tipping Feb. 1974 13 p refs
(Contract AT(29-1)-789)
(SLA-74-53) Avail: NTIS HC $3.00

Contact resistance data for three commercial-grade nickel alloys are presented. These data were obtained under stationary and wiping conditions for the metals exposed to atmospheric contaminants under accelerated oxidizing conditions. The results indicate that these nickel alloys are suitable inexpensive substitutes for precious metal electrical contact materials in a deceleration switch. However, only one of the two switch elements should be hardened. Author (NSA)

N74-31999# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
RIGID-FRAME CONNECTIONS TO CONCRETE-FILLED TUBULAR STEEL COLUMNS
Peter Ansourian (Sydney Univ.) Jan. 1974 71 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-86) Avail: NTIS HC $6.75

Rigid-frame connections between I beams of normal and wide flange section, and square steel tubes were examined experimentally in tests of nine structural units. Both welded and high strength friction bolted joints were examined. The axial load on the columns varied from 0.15 to 0.75 of their squash load. Failure of the connection occurred in three of the units, while the column failed by S-shaped instability in the other six units. The deformations of the column were analyzed in a second-order elasto-plastic numerical analysis including the effects of the axial load and the bending moment distribution existing in the tests. Where failure occurred in the column, agreement in column deformation between theory and experiment was excellent, while the calculated collapse loads were always conservative. Premature weld failure occurred in connections to the front face of the tube. The best connections were those which transmitted the beam tension flange force to the back of the filled tube. Author (ESRO)

N74-32000# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF SURFACE TENSION OF TITANIUM ALLOYS USING THE METHOD OF MELTING IN A SUSPENDED STATE
A. A. Fogel, O. N. Magnitskii, M. M. Mezdrogina, and N. I. Bronzova 24 May 1974 11 p refs Transl. into ENGLISH from the book "Voprosy Teorii Protsessov Litya" Kiev, 1969 p 80-85
(AD-780361; FTD-HT-23-1208-74) Avail: NTIS CSCL 11/6

In this work the authors studied the effect of certain rare-earth elements and rhenium on the surface tension of titanium. The surface tension values of Ce, La, Nd, and Re, determined by calculation, are lower than those for titanium. GRA

N74-32001# Dayton Univ. Research Inst., Ohio.
MECHANICAL PROPERTIES OF Ti-6Al-4V ANNEALED FORGINGS Final Report, Jun. 1971 - Oct. 1973
Russell R. Cervay Mar. 1974 32 p refs
(Contract F33615-72-C-1282; AF Proj. 7381)
(AD-779937; UDRI-TR-73-16; AFML-TR-74-49) Avail: NTIS CSCL 11/6

Tests were conducted to determine the mechanical properties of titanium 6Al-4V annealed forgings. Tensile, fracture toughness, and constant amplitude cyclic crack growth properties were obtained along with limited corrosion studies of fastener installations. The tensile properties were determined for three orientations and the fracture toughness properties for four orientations. Some of the tensile and fracture toughness specimens were subjected to a time-temperature exposure before being tested at room temperature. The mechanical properties of the annealed material were similar to those in the literature. The time-temperature exposure cycle slightly altered the mechanical properties of the material. The corrosion tests conducted on the fastener installations did not produce any cracking in the material under the test conditions. Author (GRA)

N74-32002# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF STRAIN ON THE MECHANICAL PROPERTIES OF MAGNESIUM ALLOYS ALLOYED WITH YTTRIUM
Z. A. Sviderskaya and A. A. Oreshkina 15 Apr. 1974 14 p refs Transl. into ENGLISH from the book "Splavy Tsvetnykh Metallov" USSR, 1972 p 161-166
(FTD Proj. T74-01-10)
(AD-778531; FTD-HT-23-843-74) Avail: NTIS CSCL 11/6

As a result of investigations conducted recently the favorable effect of yttrium on the properties of magnesium alloys at room and elevated temperatures was established (1-4). The highest strength level characteristics of these alloys are reached after prolonged artificial aging, carried out immediately after pressure shaping without hardening. The possibility of raising the strength properties of aging magnesium alloys by means of relatively small strain (5-10%) conducted prior to artificial aging was investigated in detail on alloys alloyed with neodium, aluminum, zinc, etc., (5-8). In this case a significant hardening effect was achieved. The translation discusses research on the feasibility of raising the strength characteristics of magnesium-yttrium alloys coupled with plastic deformation and artificial aging. GRA

N74-32003# Boston Univ., Mass. Dept. of Aerospace Engineering.
DYNAMIC PROPERTIES OF MATERIALS. PART 2: ALUMINUM ALLOYS Final Report
C. W. Jiang and M. M. Chen Apr. 1974 50 p refs
(Contract DAAG46-73-C-0181; DA Proj. 1J5-62604-A-607)
(AD-780021; AMMRC-CTR-74-23) Avail: NTIS CSCL 11/6

A literature survey on the mechanical properties of aluminum alloys under dynamic loadings has been made. The experimental data showing the variation of yield, ultimate strengths and elongation with strain rate and temperature are compiled and tabulated. The range of strain rate included in this report is from 0.00001 in/in/sec to 10,000 in/in/sec, while the temperature range is from -300F to 900F. The variations of yield and ultimate strengths are plotted for 6061 and 7075 aluminum alloys. It is shown that both the yield and ultimate strengths are higher under dynamic loads than under static loads. However, the aluminum alloys are not as strongly affected by strain rate as polymers and steels. It is also shown that the yield and ultimate strengths decrease with an increase of temperature.
Author (GRA)

N74-32004# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR DETERMINING THE THERMAL CONDUCTIVITY COEFFICIENT OF METALS AT HIGH TEMPERATURES
V. S. Kobushko, B. A. Merisov, and V. I. Khotkevich 19 Apr. 1974 14 p Transl. into ENGLISH from the monograph "Eksperimentalnaya Tekhnika i Methody Vysokotemperaturnykh Izmerenii" USSR, 1966 p 38-43
(AD-779806; FTD-HT-23-886-74) Avail: NTIS CSCL 11/6

In this work current-heated wire specimens were used in the determination of the thermal coefficient. The authors measured electrical resistance of the middle section of such a specimen which is essentially a thermometer of resistance. A regular connection between the total length of the wire and electrical resistance of its middle section was seen. The origin of this regularity is connected with the presence of the heat flux along the wire to its ends due to thermal conductivity, which, ultimately, makes it possible to determine the value of the thermal conductivity coefficient. GRA

N74-32005# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
PROCEEDINGS OF THE 1973 SYMPOSIUM ON ELECTRO-DEPOSITED METALS FOR SELECTED APPLICATIONS
William H. Safranek and Ralph G. Dermott May 1974 129 p refs Symp. held on 4-15 Nov. 1973
(Contract DSA900-74-C-0616)
(AD-779152; MICI-74-17) Avail: NTIS HC $12.25; MF $12.25 CSCL 11/3

A total of 12 papers were presented at the symposium. Important subjects discussed included, reliability of electrodeposits on aluminum electrical connectors, aluminum-manganese alloy deposits, nickel foil produced from sulfamate solutions at high deposition rates, fatigue life of nickel-plated hardened steel, nickel-cobalt alloys for electrojoining, electroless nickel deposits, oxide coatings, high-rate (over one mil per minute) deposits. In addition nondestructive testing was discussed and properties of vacuum-deposited and electrodeposited coatings were compared. (Modified author abstract) GRA

N74-32006# United States Steel Corp., Monroeville, Pa. Research Lab.
PRESSURE DEPENDENCE OF YIELDING AND ASSOCIATED VOLUME EXPANSION IN TEMPERED MARTENSITE Technical Report, 1 Oct. 1972 - 28 Feb. 1974
William A. Spitzig, Robert J. Sober, and Owen Richmond May 1974 55 p refs
(Contract N00014-73-C-0092)
(AD-780932; Rept-76-H-006-064) Avail: NTIS CSCL 11/6

The stress-strain behavior of quenched and tempered AISI 4310 and 4330 steels was examined in tension and compression under superimposed hydrostatic pressures up to 160 ksi (1104 Mn/sq m). The results showed that yield and flow stresses were sensitive to hydrostatic pressure, but that work hardening and the magnitude of the strength-differential (S-D) effect between compression and tension were relatively intensitive. Measurements of the volume changes occurring during plastic deformation at atmospheric pressure showed that the plastic volume expansion was larger than that measured in materials which show a smaller S-D effect. They also showed, however, that the plastic volume change was a small portion of the total volume expansion during plastic deformation. The observations on pressure dependence of yielding were used to derive a specific yield condition for these steels, and the observations on volume expansion were then used to test the normality of the plastic-strain-rate vector to this yield surface. Contrary to the widely accepted theory, the results suggest that the total strain-rate vector, rather than the plastic portion, is normal to the yield surface. Author (GRA)

N74-32007# Army Materials and Mechanics Research Center, Watertown, Mass.
INVESTIGATION OF MICROQUENCHED MAGNESIUM ZK60A ALLOY Final Report
Saul Isserow Apr. 1974 21 p refs
(DA Proj. 1T1-611101-A-91A)
(AD-780799; AMMRC-TR-74-7) Avail: NTIS CSCL 11/6

The substantial improvement of tensile behavior and impact resistance of magnesium ZK60A alloy by microquenching was confirmed. Metallographic examination showed that much of the strengthening, observed to approach 20 ksi, is attributable to the unusually fine grain size in rods extruded from microquenched powder. The powder itself is not unusually fine-grained but seems to embody features that make the consolidated material highly responsive to cold working, recrystallization, and aging. The grain size of the consolidated rods can, with a reasonable value for the Hall-Petch constant, be shown to account for the strength increment relative to ordinary commercial material obtained by casting and working. The powder-derived material also contains a fine intermetallic precipitate. The powder-derived material showed a fracture mode in both tension and impact tests that strongly involves separation or debonding of parallel strands. This fracture occurs in steps, is slower than the ordinary shear fracture, and absorbs much more energy. (Modified author abstract) GRA

N74-32008# Army Construction Engineering Research Lab., Champaign, Ill.
CYCLIC MECHANICAL TESTS AND AN APPROPRIATE ANALYTICAL STRESS-STRAIN MODEL FOR A36 STEEL Final Report
J. F. Martin May 1974 60 p refs
(DA Proj. 4A1-61102-B-52E)
(AD-780802; CERL-TR-M-86) Avail: NTIS CSCL 11/6

The report establishes the monotonic and steady-state cyclic stress-strain properties for smooth, uniaxially-loaded specimens of A36 steel. Transient characteristics of cyclic hardening and softening and cyclic relaxation of mean stress are investigated. Deflection versus load and strain versus load are reported for a simple beam subjected to three-point bending. Six computer programs are included. These programs were developed to fit specific needs of the finite element program for determining energy dissipation in dynamically loaded structures. Author (GRA)

N74-32009# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
LOW-TEMPERATURE HEAT CAPACITY AND HIGH-TEMPERATURE ENTHALPY OF TiAl3
J. M. Stuve and M. J. Ferrante Mar. 1974 14 p refs
(PB-231281/7; BM-Ri-7834) Avail: NTIS HC $3.00 CSCL 11F

Thermodynamic properties were determined for the intermetallic compound TiAl3. Heat capacities were obtained from 5 to 303K by adiabatic calorimetry. Enthalpies relative to 298K were obtained from 298 to 1,413K by copper-block drop calorimetry. Gibbs free energies of formation are given: 0 to 1,400K. (Modified author abstract) GRA

N74-32010# Cabot Corp., Kokomo, Ind. Satellite Div.
FEASIBILITY OF MAKING AN OXIDE DISPERSION-STRENGTHENED COBALT-BASE ALLOY BY MECHANICAL ATTRITION Final Report, 1 Jul. - 31 Dec. 1973
D. L. Klarstrom and R. Grierson Mar. 1974 77 p refs
(Contract F33615-73-C-5150)
(AD-779934; AFML-TR-74-34) Avail: NTIS CSCL 11/6

The feasibility of making an oxide dispersion-strengthened, Cobalt-base alloy by mechanical attrition was investigated. The optimum blend of starting powders to produce a Co-20Ni-18Cr-1Y2O3 base composition was determined. Using this blend, four different alloys were produced: two contained 1% and 2% Y2O3 and no aluminum, and two contained 1% and 4% aluminum with 1% Y2O3, respectively. A full scale property evaluation was performed for each alloy composition on extrusions produced at four different temperatures with a reduction ratio of 16:1. (Modified author abstract) GRA

N74-32011# Naval Ship Research and Development Center, Annapolis, Md.
AN INVESTIGATION OF THE PLASTIC FRACTURE OF HIGH-STRENGTH STEELS
T. B. Cox Jun. 1974 49 p refs
(AD-780777; NSRDC-4296) Avail: NTIS CSCL 11/6

The mechanisms of plastic fracture (dimpled rupture) in high-purity and commercial 18 Ni, 200 grade maraging steels and quenched and tempered AISI 4340 steels have been studied. Plastic fracture takes place in the maraging alloys through void initiation by fracture of titanium carbonitride inclusions and the growth of these voids until impingement results in coalescence and final fracture. The fracture of AISI 4340 steel occurs by nucleation and subsequent growth of voids formed by fracture of the interface between manganese sulfide inclusions and the matrix. The sizes of nonmetallic inclusions are an important aspect of the fracture resistance of these alloys, since void nucleation occurs more readily at the larger inclusions and that void growth also proceeds more rapidly from the larger inclusions. (Modified author abstract) GRA

N74-32012# Army Materials and Mechanics Research Center, Watertown, Mass.
FUNDAMENTAL CONSIDERATIONS IN THE DEVELOPMENT OF IMPROVED BERYLLIUM FOR MISSILE STRUCTURES Final Report
Lewis R. Aronin May 1974 20 p refs
(DA Proj. 1W1-62113-A-661)
(AD-780820; AMMRC-MS-74-6) Avail: NTIS CSCL 11/6

The paper discusses recent improvements in beryllium in

terms of its basic deformation and alloying behavior. Recent advances in beryllium are attributable to three factors in addition to impurity control: (1) powder production by impact attritioning; (2) consolidation of isotropic material by hot isostatic compaction; and (3) development of plasma spraying as a consolidation technique. Properties attainable in these materials are discussed. Further evaluations of these materials under biaxial and dynamic load conditions are required. Fabrication and testing of structures under simulated load conditions are recommended. (Modified author abstract) GRA

N74-32013# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
REVERSE LOADING EFFECTS IN BEND TESTS ON HOT ISOSTATICALLY PRESSED (HIP) BERYLLIUM Final Report, Nov. 1972 - Jun. 1973
T. Nicholas and M. J. Sever Mar. 1974 32 p refs
(AF Proj. 7351)
(AD-781065; AFML-TR-73-258) Avail: NTIS CSCL 11/6

Results of four-point bend tests on two grades of hot isostatically pressed (HIP) beryllium are presented. Both one-directional and reversed loading were used to evaluate the effects of precompression on the subsequent tensile strain to failure. Additional tests on wide-bend specimens were used to evaluate the response of beryllium in bending under plane strain conditions. Stress-strain curves calculated from the results of bend tests indicate that flow stresses are higher than those obtained from uniaxial tension tests. Author (GRA)

N74-32014# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEVELOPMENT OF TiAl BY EXTRUSION OF ELEMENT POWDER MIXTURE M.S. Thesis
Robert E. Schafrik Mar. 1974 124 p refs
(AF Proj. 7021)
(AD-780630; GAW/MC/74-16) Avail: NTIS CSCL 11/6

The experimental study investigated the preparation of TiAl (gamma-phase) directly from a mixture of the elemental powders. Selected properties of this material were compared with those of TiAl manufactured from prealloyed powders. Densification of the powders was achieved by direct extrusion at an elevated temperature. The powders were extruded while encased in a titanium billet. The process variables that were investigated were: pre-sinter conditions, heat treating conditions, and effect of extrusion conditions on the physical properties of the product. (Modified author abstract) GRA

N74-32015# Boston Univ., Mass. Dept. of Aerospace Engineering.
DYNAMIC PROPERTIES OF MATERIALS. PART 3: STEELS Final Report
P. Soohoo, C. W. Jiang, and M. M. Chen Apr. 1974 96 p refs
(Contract DAAG46-73-C-0181; DA Proj. 1J5-62604-A-607)
(AD-780026; AMMRC-CTR-74-24) Avail: NTIS CSCL 11/6

A survey of the literature has been conducted to obtain and compile existing experimental data on the pertinent mechanical properties of steels subject to dynamic loading conditions and under a wide temperature range. Data showing the variation of yield strength and elongation with strain rate and temperature are categorized and tabulated. The effect of the dynamic properties of steels due to strain rate variation at room temperature is shown graphically. Separate curves for steels in tension and compression are presented. A comprehensive reference and bibliography section is provided. The behavior of steels under dynamic loading is generally different from that under static loading. The yield strength is higher under dynamic loading, and it decreases with increasing temperature. (Modified author abstract) GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-32016*# University of Southern California, Downey. Rehabilitation Engineering Center.
THE USE OF PURE CARBON FOR PERMANENT PERCUTANEOUS ELECTRICAL CONNECTOR SYSTEMS
Vert Mooney, David B. Hartmann, Donald McNeal, and Jim Benson (Bentley Labs., Irvine, Calif.) [1973] 23 p refs
(Contracts NAS8-28117; Contract NAS8-28620)
(NASA-CR-120383) Avail: NTIS HC $4.25 CSCL 11D

Pure carbon was used as an electrode in the clinical application of long-term neuromuscular stimulation, as well as a connector for permanent neuroelectrodes. The history of this material and some examples of the material in use are presented. Author

N74-32017*# General Electric Co., Schenectady, N.Y. Metallurgy and Ceramics Lab.
COATINGS FOR DIRECTIONAL EUTECTICS Final Report, 27 Mar. - 27 Dec. 1973
M. R. Jackson, J. R. Rairden, and L. V. Hampton Jan. 1974 101 p refs
(Contract NAS3-16793)
(NASA-CR-134665; SRD-74-047) Avail: NTIS HC $8.25 CSCL 11D

Coating compositions were evaluated for oxidation protection of directionally solidified composite alloy NiTaC-13. These coatings included three NiCrAlY compositions (30-5-1, 25-10-1 and 20-15-1), two FeCrAlY compositions (30-5-1 and 25-10-1), a CoCrAlY composition (25-10-1), and one duplex coating, Ni-35Cr + Al. Duplicate pin samples of each composition were evaluated using two cyclic furnace oxidation tests of 100 hours at 871 C and 500 hours at 1093 C. The two best coatings were Ni-20Cr-15Al-IY and Ni-35Cr + Al. The two preferred coatings were deposited on pins and were evaluated in detail in .05 Mach cyclic burner rig oxidation to 1093 C. The NiCrAlY coating was protective after 830 hours of cycling, while the duplex coating withstood 630 hours. Test bars were coated and cycled for up to 500 hours. Tensile tests indicated no effect of coatings on strength. In 871 C air stress rupture, a degradation was observed for coated relative to bare material. The cycled NiCrAlY coating offered excellent protection with properties superior to the bare cycled NiTaC-13 in 1093 C air stress rupture. Author

N74-32018*# Boeing Aerospace Co., Seattle, Wash.
DEVELOPMENT OF POLYPHENYLQUINOXALINE GRAPHITE COMPOSITES Final Report, 1 Apr. 1973 - 15 Jun. 1974
J. T. Hoggatt, S. G. Hill, and J. G. Shdo Jul. 1974 104 p refs
(Contract NAS3-16799)
(NASA-CR-134674) Avail: NTIS HC $8.25 CSCL 11D

This exploratory program was divided into four basic tasks. The initial phase was devoted toward investigating processing variables associated with previously developed PPQ resins. These polymers were derived from p-bis(phenyl glyoxalyl)benzene reacted with 3,3'-diamino benzidine and/or 3,3',4,4'-tetramino benzophenone. Four new phenyl quinoxaline polymers were synthesized and characterized in Tasks 2 and 3. These consisted of a hydroxyl group containing PPQ synthesized from 3,3'-diamino benzidine (DAB), m-bis(phenyl glyoxal)benzene and m-bis(p'-hydroxy phenyl glyoxalyl) benzene; a cyano group containing PPQ from the reaction of DAB and p-bis(p'-cyano phenoxy phenyl glyoxalyl) benzene; an end-capped block copolymer; and a polymer from the reaction of 3,3',4,4'-tetraamino benzo phenone and m-bis (phenyl glyoxalyl)benzene. The latter two polymers were chosen for composite studies in the latter two tasks of the program. Mechanical properties of the graphite reinforced PPQ composites were determined over the temperature range of +21 C to 316 C. Flexural strengths of the HMS graphite fiber composites were in excess of 8.97 X 10 to the 8th power N/sq m

(130,000 psi) at +21 C (70 F) with over 50% strength retention at +316 C. Author

N74-32019# Sandia Labs., Albuquerque, N.Mex.
ELECTROOPTIC CERAMIC MATERIALS AND DEVICES
C. E. Land 1974 10 p refs Presented at Region 6 Conf., Albuquerque, N. Mex., 24 Apr. 1974 Sponsored by AEC
(SLA-74-5117; Conf-740404-1) Avail: NTIS HC $3.00

An electrooptic ceramic is a transparent or partially transparent polycrystalline ferroelectric material. Electrooptic ceramics investigated thus far belong to the lead zirconate titanate Pb(Zr,Ti)O3 solid solution system. By far the most useful electrooptic materials in this system are the lanthanum-modified (Pb, La)(Zr,Ti)O3 ceramics. Electrooptic effects in these ceramics are being considered for a number of device applications including spectral and variable density filters, polarization switches, light shutters, page composers for holographic memories, information and image storage devices, and various types of displays. This paper briefly describes the electrooptic effects in ceramics and discusses their device applications. Author (NSA)

N74-32020# Sandia Labs., Albuquerque, N.Mex.
DETERMINATION OF EFFECTIVE THERMAL DIFFUSIVITY FOR A TWO-LAYER COMPOSITE LAMINATE
W. P. Schimmel, Jr. and A. B. Donaldson 1973 11 p refs Presented at the 13th Intern. Conf. on Thermal Conductivity, Lake Ozark, Mo., 5 Nov. 1973 Sponsored by AEC
(SLA-73-5695; Conf-731106-4) Avail: NTIS

The problem of thermal conduction in a two layer composite was investigated by representing the composite as a single layer with an effective thermal diffusivity. The response of the adiabatic rear surface of a slab subjected to a step change in temperature at the front surface was determined. An expression was derived for the effective diffusivity which is in agreement with an exact analysis for cases in which the relative error parameter is small. The effective analysis provides somewhat erroneous results for early times when the parameter is large, but the agreement becomes acceptable at later times. It is not anticipated that any particular difficulty will arise in extending the method to multilayer problems, except for the complexity of manipulation.
Author (NSA)

N74-32021# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF COMPOSITE BODIES WEAKENED BY CRACKS
L. T. Berezhnitskii, V. V. Panasyuk, and G. P. Cherepanov 19 Apr. 1974 13 p refs Transl. into ENGLISH from Kontsentratsiya Napryazh. (USSR), no. 3, 1971 p 10-15
(AD-779836; FTD-HT-23-1489-74) Avail: NTIS CSCL 11/4

The plane problem of determining the critical load for the most characteristic case of a two-component composite with a crack, when the line of separation of the component parts is a circle, was examined. Two elastic materials, one of the inclusion, and the other of the binder, were features of the composite under investigation. The case of a round inclusion under plane problem conditions was also examined. A.A.D.

N74-32022# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MATERIAL SELECTION AND TESTING FOR THERMAL RADIATION SHIELDING M.S. Thesis
Frank J. Vondersaar Mar. 1974 80 p refs
(AD-779943; GNE/PH/74-9) Avail: NTIS CSCL 11/7

The report includes procedures for selection and testing of advanced thermal protection materials for use on an absorptive, lightweight, thermal radiation flash shield to protect aircraft crews from a nuclear weapon thermal pulse. Included are a survey of thermal protection systems and materials, techniques for simulation of a nuclear weapon thermal pulse, testing procedures and equipment description, heat transfer theory and a computer code developed to model the flash shield. The code uses an implicit numerical solution method to solve the one-dimension, transient, heat conduction equation for a multilayer slab. Also shown in the report are results of testing and a final optimal shield design, with weight, cost, and safety information for the proposed shield. Author (GRA)

N74-32023# Avco Corp., Wilmington, Mass.
SELF-DIFFUSION IN SILICON NITRIDE Interim Report, 1 Jan. - 31 Dec. 1973
Bernhart J. Wuensch and Thomas Vasilos Apr. 1974 38 p refs
(Contract N00014-73-C-0212)
(AD-779901) Avail: NTIS CSCL 11/2

Progress is described in the first year of a program designed to obtain simultaneous measurement of Si and N self-diffusion coefficients in silicon nitride. Comparative measurements will be made at a given temperature in a variety of materials. Measurements will also be made as a function of temperature for one well characterized material. Neither Si nor N has an isotope suitable for use as a radiotracer. The stable isotopes Si29 and N15 are therefore being used as tracers. Mass spectrometry applied to sections removed serially from a sample will be used to establish isotope distributions. Determination of N15/N14 is being obtained from N2 using gas spectrometry; measurement of Si29/Si30 is being determined from BaSiF6 with hot filament analysis. (Modified author abstract) GRA

N74-32024# California Univ., Los Angeles. School of Engineering and Applied Science.
AN EXPERIMENTAL STUDY ON THE COMPRESSIVE BIAXIAL STRENGTH OF CERAMICS Annual Technical Report, 8 Nov. 1972 - 9 Jan. 1974
George Sines and Marc Adams Jan. 1974 62 p refs
(Contract N00019-73-C-0294)
(AD-779900; UCLA-ENG-7395) Avail: NTIS CSCL 11/2

To predict the strength under mechanical and thermal loading, and predict the improvement in strength by prestressing or preloading, it is necessary to know the strength under biaxial stresses, and for some thick sections even triaxial stresses. Biaxial stresses state testing was conducted in the compression-compression quadrant. Data was obtained which will allow the determination of the failure envelope in this quadrant. Hopefully, the data will ultimately help establish a comprehensive theory of the biaxial strength of high density, high strength brittle materials such as alumina, silicon carbide, and silicon nitride.
GRA

N74-32025# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
STRENGTH OF GLASS: A FRACTURE MECHANICS APPROACH Interim Report, 1 Jul. 1973 - 30 Jun. 1974
S. M. Wiederhorn May 1974 18 p refs
(NR Proj. 032-517)
(AD-780704; NBSIR-74-485) Avail: NTIS CSCL 11/2

After a brief review of those factors that determine the strength of glass (brittleness, surface flaws, susceptibility to stress corrosion cracking), a discussion is given of how fracture mechanics techniques can be used to understand the physics and chemistry of glass strength. In this paper it is assumed that the strength of glass is limited by the growth of cracks that are always present in normal glass surfaces. Fracture mechanics techniques can be used to characterize the crack growth and to relate the growth to experimental parameters such as temperature, environment and glass composition. Crack growth data obtained in this manner can be used to develop a deeper understanding of fracture mechanisms, and to develop charts that can be used for the design of glass structural components. Examples of both applications are given.
Author (GRA)

N74-32026# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
RELIABILITY, LIFE PREDICTION AND PROOF TESTING OF CERAMICS Interim Report, 1 Jul. 1973 - 30 Jun. 1974
S. M. Wiederhorn May 1974 56 p refs
(AD-780705; NBSIR-74-486) Avail: NTIS CSCL 11/2

A critical review is presented of the use of proof testing as a design method for assuring the reliability of structural components. The advantage of proof testing over the statistical approach used for design lies in the insensitivity of the proof testing method to the detailed history of handling or processing of structural components. Methods are presented for developing and using proof test diagrams to assure component lifetime after proof testing. Procedures of proof testing and precautions that

must be followed during proof testing are discussed. Provided these precautions are followed, proof testing offers a general method for assuring the reliability of structural components under stress. Author (GRA)

N74-32027# Naval Air Propulsion Test Center, Trenton, N.J.
EVALUATION OF MIL-L-23699 LUBRICANT PERFORMANCE IN THE T58 ENGINE Final Report
Frank Feinberg Jun. 1974 15 p refs
(AD-780716; NAPTC-PE-41) Avail: NTIS CSCL 11/8

An evaluation was made of the service performance characteristics of MIL-L-23699 oils in these engines. Operational experience and problems as well as the condition of the lubricant wetted engine components at overhaul are discussed. Recommendations are made concerning the expected life of MIL-L-23699 oils in these engines. Author (GRA)

N74-32028# Army Natick Labs., Mass.
RESPONSE OF POLYMERS TO TENSILE IMPACT. 2: EXTENSION OF THE INTEGRAL-EQUATION, SUCCESSIVE-SUBSTITUTION SOLUTION TO NONLINEAR, TIME-INDEPENDENT MATERIALS
Prescott D. Crout, Malcolm N. Pilsworth, Jr., and Harold J. Hoge Feb. 1974 87 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-780811; USA-NLABS-TR-74-26-PR) Avail: NTIS CSCL 11/9

An integral-equation, successive-substitution solution for the propagation of strain waves in a linear elastic material, developed in an earlier paper, is here extended to non-linear materials without creep (time-independent materials). A previously-published problem, based on experimental data for nylon string, is solved by the successive-substitution method and compared with the earlier solution obtained by the method of characteristics. In the region where the stress-strain curve of the nylon is concave upward, a tendency to oscillation builds up and the solution eventually oscillates. Oscillations in the strained portion of a string are examined theoretically and it is shown that the energy of standing waves can be used to obtain energy conservation. Although the successive-substitution method generates oscillations when it has to deal with a discontinuity in strain, the possibility that oscillations also actually exist as a means of conserving energy cannot be ruled out. (Modified author abstract) GRA

N74-32029# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
SILICONE WAX REMOVAL FROM PAINTED SURFACES
G. Pilla 2 Apr. 1974 11 p
(AD-780775; NADC-74042-30) Avail: NTIS CSCL 11/3

A simplified procedure for the removal of silicone wax from painted aircraft surfaces prior to paint touch up operations is described. Author (GRA)

N74-32030# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF HEATPROOF MATERIALS IN NONSTEADY-STATE OPERATING CONDITIONS
B. M. Pankratov, O. M. Alifanov, A. A. Ivanov, and A. D. Markin 30 Apr. 1974 16 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 24, no. 1, Jan. 1973 p 75-83
(AD-780826; FTD-HT-23-909-74) Avail: NTIS CSCL 11/2

The present paper deals with the problem of transient heating and ablation of heat-proof coatings of flight vehicles. An analysis is made of the effect of transient parameters on the characteristics of hypersonic ablation and heating of glassy coatings. An implicit finite-difference procedure of calculation of unsteady thermal conditions at the boundary of a plate whose properties are dependent on temperature is presented. (Modified author abstract) GRA

N74-32031# Southwest Research Inst., San Antonio, Tex.
BALLISTIC PENETRATION EFFECTS ON BIAXIALLY LOADED GRAPHITE/EPOXY COMPOSITE PANELS Contractor Report, Sep. 1972 - Sep. 1973
P. H. Francis, A. Nagy, H. G. Pennick, and H. H. Calvit Apr. 1974 79 p refs
(Contract DAADO5-73-C-0017)
(AD-780730; BRL-CR-148) Avail: NTIS CSCL 11/4

The behavior of laminated plates of graphite/epoxy subjected to 0.30 cal. AP projectile impact was studied experimentally and analytically. The threshold strength and residual strength of these panels were determined, and, in the process, some measure of the cumulative effects of bending, shear and compression waves in the plates was obtained from the difference between the threshold and the residual strengths. Author (GRA)

N74-32032# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HARD-BODY IMPACT DAMAGE EFFECTS ON BORON-ALUMINUM COMPOSITES M.S. Thesis
John G. Carlisle Mar. 1974 106 p refs
(AD-780612; GAM/MC/74-M-1) Avail: NTIS CSCL 11/4

The investigation was conducted to study the effects of foreign object damage on the residual tensile and tensile fatigue strength of a composite material, unidirectional boron-aluminum-6061. Curves were generated for various levels of tensile prestress during the ballistic impaction which related velocity of impact with the residual tensile strength of the specimens. The composite material was further characterized by tensile fatigue tests, radiography, and photography. A similar damage and fatigue analysis was done for Ti-6Al-4V to provide baseline data with which to compare the composite. All tests were carried out in lab air and at room temperature. It was concluded that for a given level of impact damage B/Al-6061 suffers much greater total loss and percentage loss of residual tensile strength than does Ti-6-4. Also, a fracture mechanics model fits the failure stress versus crack length data for B/Al-6061 resulting from hard-body impact. Author (GRA)

N74-32033# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SOFT BODY IMPACT DAMAGE EFFECTS ON BORON-ALUMINUM COMPOSITES M.S. Thesis
William J. Jaques Mar. 1974 119 p refs
(AD-780628; GAW/MC/74-13) Avail: NTIS CSCL 11/4

The purpose of the experimental study was to investigate and document the effects of soft body impact damage on the residual tensile and axial fatigue strength of Boron-6061 Aluminum composite material. Unidirectional B-6061 Al specimens were impacted with room temperature vulcanizing rubber (TVR) spheres in a powder charge gun facility. Specimens were also impacted under five different tensile loads. Residual tensile strength versus impact velocity plots were generated for each prestress level. The composite was further characterized by axial fatigue and nondestructive tests. All tests were carried out at room temperature. A similar damage and residual strength analysis was done for Ti-6Al-4V to provide baseline data against which to compare the composite. It was concluded that Ti-6Al-4V is much more resistant to impact damage than unidirectional B-6061 Al. A fracture mechanics analysis is presented and a fracture mechanics model proposed for unidirectional B-6061 Al impacted specimens. Author (GRA)

N74-32034# Washington Univ., St. Louis, Mo. Materials Research Lab.
BASIC FAILURE OF COMPOSITES. PART 1: DATA AVERAGING OF ANISOTROPIC COMPOSITE MATERIAL CONSTANTS Technical Report, 1 May 1971 - 1 May 1972
Edward M. Wu and R. E. Lavengood Nov. 1973 42 p refs
(Contract F33615-71-C-1404; AF Proj. 7342)
(AD-781130; AFML-TR-73-272-Pt-1) Avail: NTIS CSCL 11/4

Material parameters which are dependent on direction of orientation can best be represented by tensors of appropriate ranks. Using tensor transformation rule and associated scalar invariants of the tensor, experimental data can be averaged and reduced to compact constants for engineering documentation and retrieval. Examples on data averaging of composite swelling coefficients and of elastic compliances illustrate the simplicity and viability of this tensor averaging methodology. Author (GRA)

N74-32035# Washington Univ., St. Louis, Mo. Materials Research Lab.
BASIC FAILURE OF COMPOSITES. PART 2: DIAGNOSTIC

EXPERIMENT FOR LAMINATE FAILURE Technical Report, 1 May 1972 - 1 Apr. 1973
Edward M. Wu and James Scheublein Nov. 1973 58 p refs
(Contract F33615-71-C-1404; AF Proj. 7342)
(AD-781131; AFML-73-272-Pt-2) Avail: NTIS CSCL 11/4

Diagnostic experiments indicated that given a reliable lamina failure criterion, the laminated plate theory can provide a reasonable prediction of the laminate failure. Additional refinements lie in the areas of (1) accounting for nonlinear stress-strain relationships in laminated plate theory, (2) analyzing in detail the intra-lamina stresses, (3) using experimental capabilities of external pressure for tubular specimens and (4) developing the higher order failure tensor for direct phenomenological failure characterization. Author (GRA)

N74-32036# Boston Univ., Mass. Dept. of Aerospace Engineering.
DYNAMIC PROPERTIES OF MATERIALS. PART 1: POLYMERS Final Report
C. W. Jiang and M. M. Chen Apr. 1974 88 p refs
(Contract DAAG46-73-C-0181; DA Proj. 1J5-62604-A-607)
(AD-780020; AMMRC-CTR-74-22) Avail: NTIS CSCL 11/9

A survey of literature on the mechanical behavior of polymers subject to dynamic loads in a wide temperature range has been made. The data showing the variation of yield strength, and elongation with strain rates and temperatures were tabulated and plotted; the results obtained from tension and compression modes of loading are graphed separately. A comprehensive reference section is provided. It is observed that the behavior of polymers under dynamic loading is different from static loading. The yield strengths are generally higher under dynamic loading than the static ones and they decrease with an increase of temperature. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-32037# Ecole Normale Superieure, Paris (France). Lab. de Physique Theorique.
INFINITE COMPONENT FIELD THEORY OF INTERACTING RELATIVISTIC STRINGS AND DUAL THEORY
E. Cremmer and J. L. Gervais Jun. 1974 78 p refs
(LPTHE-74/25) Avail: NTIS HC $7.00

Using light-cone quantization, the multistring formalism is unambiguously established from operator formalism, by introducing an infinite component field which is a key vector in the Fock space of transverse oscillators. The interaction corresponding to the dual vertex of A.D.D.F. is determined. A functional multistring field is naturally obtained where the string operator is diagonal. It differs from Kaku and Kikkawa's one by an infinite phase factor which does not allow them to take the value of the intercept into account. In this way, the functional approach to the dual amplitude is recovered with a well-defined functional measure which could not have been guessed a priori, and which is determined from previously established expression of the vertex. The scattering amplitudes are deduced from field-theory asymptotic conditions and perturbation theory. On-shell amplitudes are shown to agree with the form proposed by Mandelstam integrated over time differences instead of Koba-Nielsen variables. Two prescriptions for off-shell amplitudes are discussed. Author

N74-32038*# Scientific Translation Service, Santa Barbara, Calif.
ON APPROPRIATE CAUCHY PROBLEMS
Heinz-Otto Kreiss Washington NASA Aug. 1974 32 p refs
Transl. into ENGLISH from Math. Scand. (West Ger.), v. 13, 1963 p 109-128
(NASA-TT-F-15893) Avail: NTIS HC $4.75 CSCL 12A

Systems of partial differential equations and their coefficients are discussed. Problems equivalent to the original Cauchy problems are formulated and solved. Author

N74-32039*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
SURFACE FITTING THREE-DIMENSIONAL BODIES Final Report, May 1973 - Jul. 1974
Fred R. DeJarnette Jul. 1974 82 p refs
(Grant NGR-34-002-193)
(NASA-CR-139663) Avail: NTIS HC $7.25 CSCL 12A

The geometry of general three-dimensional bodies is generated from coordinates of points in several cross sections. Since these points may not be smooth, they are divided into segments and general conic sections are curve fit in a least-squares sense to each segment of a cross section. The conic sections are then blended in the longitudinal direction by fitting parametric cubic-spline curves through coordinate points which define the conic sections in the cross-sectional planes. Both the cross-sectional and longitudinal curves may be modified by specifying particular segments as straight lines and slopes at selected points. Slopes may be continuous or discontinuous and finite or infinite. After a satisfactory surface fit has been obtained, cards may be punched with the data necessary to form a geometry subroutine package for use in other computer programs. At any position on the body, coordinates, slopes and second partial derivatives are calculated. The method is applied to a blunted 70 deg delta wing, and it was found to generate the geometry very well. Author

N74-32040*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
ADAPTIVE PROCESSING WITH A DECISION-DIRECTED KALMAN FILTER AND FEATURE EXTRACTION OF MULTISPECTRAL DATA Technical Report, 1 Feb. - 31 Oct. 1973
R. B. Crane Jul. 1974 65 p refs
(Contract NAS9-9784)
(NASA-CR-140202; ERIM-190100-31-T) Avail: NTIS CSCL 05B

A class of adaptive decision-directed classifiers based on the Kalman filter theory are presented. Test results are shown for some simple classifiers which indicate that adapting improves classification accuracy. Memory and computational requirements can be reduced significantly over those normally associated with Kalman filters. Auxiliary training data can be used in a way that should reduce the probability of signature capture. A method is presented for feature extraction of multispectral scanner data. The method is the formation of a subset of linear combinations of the data from all the spectral channels prior to recognition processing. This method is compared to the selection of a subset of the pure spectral channels prior to recognition processing. Training data are used to define both processes. Non-training data are then used to demonstrate the level of performance, given the reduction in the number of channels entering the recognition processor and using feature extraction rather than feature selection. Author

N74-32041# Nihon Univ., Tokyo (Japan). Coll. of Science and Engineering.
MULTIPLE SCATTERING FROM OVERLAPPING POTENTIALS: THE EFFECTIVE PROPAGATOR APPROXIMATION
Mitsuaki Obu [1974] 32 p refs
(NUP-A-74-11) Avail: NTIS HC $4.75

The problem of scattering from an assembly of overlapping potentials is solved using a theoretical technique called effective propagator approximation which can describe the offshell effects due to the overlap of potentials. The solution involves a matrix inversion similar to that found previously in treating scattering from non-overlapping potentials or from separable potentials. The approximation consists in replacing a translational phase factor by a set of effective propagator functions which compensate for the neglection of the principal-value part of the Green's function. These functions are determined by means of a variational principle so as to minimize the error coming from the replacement. The method is shown to reproduce as special cases the exact solutions to the problems with non-overlapping potentials and with separable ones, and is expected to work in the case of realistic, inseparable and overlapping potentials. Author

N74-32042*# Oklahoma State Univ. Research Foundation, Stillwater. Dept. of Mathematics.
MULTIPLE ZEROS OF POLYNOMIALS
Craig A. Wood [1974] 329 p refs
(Grant NGR-37-002-084)

(NASA-CR-139675) Avail: NTIS HC $19.50 CSCL 12A

For polynomials of higher degree, iterative numerical methods must be used. Four iterative methods are presented for approximating the zeros of a polynomial using a digital computer. Newton's method and Muller's method are two well known iterative methods which are presented. They extract the zeros of a polynomial by generating a sequence of approximations converging to each zero. However, both of these methods are very unstable when used on a polynomial which has multiple zeros. That is, either they fail to converge to some or all of the zeros, or they converge to very bad approximations of the polynomial's zeros. This material introduces two new methods, the greatest common divisor (G.C.D.) method and the repeated greatest common divisor (repeated G.C.D.) method, which are superior methods for numerically approximating the zeros of a polynomial having multiple zeros. These methods were programmed in FORTRAN 4 and comparisons in time and accuracy are given. Author

N74-32043# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

ASYMPTOTICALLY FLAT SPACETIMES

Martin Walker Oct. 1972 58 p refs

(MPI-PAE-Astro-54) Avail: NTIS HC $6.00

An account is presented of Penrose's notion of conformal infinity as applied to asymptotically flat vacuum spacetimes. Spinor algebra and calculus, based essentially on an approach of Ehlers, is discussed along with Penrose's definition of points at infinity in Minkowski's (flat) spacetime. The generalization of these ideas to spacetimes in general relativity which describe the fields of bounded sources were also analyzed. The general properties of such spacetimes which were derived using the conformal approach are given, including a more detailed version of a topological argument by Geroch. The Peeling Theorem of Sachs is proved. Some remarks are made about the asymptotic version of the characteristic initial value problem, the Bondi-Metzner-Sachs asymptotic symmetry group, and the definition of energy-momentum for isolated systems. Attempts to define angular momentum and multipole-moments are mentioned. Author

N74-32044# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

AN ALGORITHM FOR SPLINE INTERPOLATION

M. G. Cox Dec. 1973 28 p refs

(NPL-NAC-27) Avail: NTIS HC $4.50

A numerically stable algorithm for the interpolation of equally or unequally-spaced data by a spline of arbitrary degree is described. The knots of the spline may be specified in arbitrary positions, as long as a condition relating to the existence of a unique solution is satisfied. In particular, it is not necessary for any of the knots to coincide with data points. For reasons of economy and numerical stability in the formation and solution of the linear equations defining the parameters of the spline, the latter is represented as a linear combination of B-splines. It is shown, however, that for purposes of subsequent rapid evaluation, conversion of the representation into piecewise-Chebyshev-series form is both straight forward and desirable. Numerical examples are appended. Author (ESRO)

N74-32045# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

CURVE FITTING: A GUIDE AND SUITE OF ALGORITHMS FOR THE NON-SPECIALIST USER

M. S. Cox and J. G. Hayes Dec. 1973 57 p refs

(NPL-NAC-26) Avail: NTIS HC $6.00

A set of basic curve fitting algorithms is presented, written in ALGOL 60, together with detailed recommendations and advice on their use. Its aim is to provide a unified system which will enable the nonspecialist user to deal with most curve fitting problems which arise in practice. The methods are based on the use of polynomials and cubic splines, and deal with data given either as a set of points or as a graph. FORTRAN versions of the algorithms were also prepared. Author (ESRO)

N74-32046# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

ON THE NUMERICAL SOLUTION OF A ONE DIMENSIONAL DIFFUSION PROBLEM WITH A MOVING BOUNDARY

D. H. Ferriss and Susan Hill Feb. 1974 30 p refs

(NPL-NAC-45) Avail: NTIS HC $4.50

Two methods that were employed to compute an approximate solution to a partial differential equation representing a one dimensional moving boundary problem are described. The first method employed a transformation of one of the independent variables in order to fix the moving boundary, and a conventional finite difference technique was used to solve the resulting nonlinear transformed equation. The second method used the analytic solution of a diffusion problem in a region of fixed extent to construct an associated time dependent boundary condition yielding a solution within the region which satisfied the original conditions. Numerical results are presented for both methods, and their relative merits are discussed. Author (ESRO)

N74-32047# European Space Research Organization, Paris (France).

AN EVOLUTION-LINEARIZING ROUTINE TO REPRESENT NUMERICAL DATA BY ARBITRARY FUNCTIONS

Peter Plaschko, K. Wagner et al Jun. 1974 70 p refs Transl. into ENGLISH of Evolutions-Linearisierungs-Programm zur Darstellung von Numerischen Daten durch Beliebige Funktionen, DLR-FB-73-55, DFVLR, 16 Mar. 1973

(ESRO-TT-60; DLR-FB-73-55) Avail: NTIS HC $6.50; DFVLR, Porz, West Ger. 19,50 DM

A method is given for interpolating digital data or interpreting them by means of theoretical models. The procedure is based on generalizing or replacing the method of linear estimation. Iteration around initially given and subsequently corrected parameters, a method that is based on linearization, readily suggests itself as a generalization of the least square error in the case of nonlinear parameter dependency; it leads to a relatively simple algorithm and high computation speeds, but does not converge for all initial parameters. Evolution strategy is a method that seeks to solve the minimum problem in analogy with biological processes. Standard distributed numbers are added to the initial parameters, the corresponding values of the function to be minimized are compared, and a better minimum is then sought. This method needs a great deal of computation time. A combination of these two methods leads to a procedure that improves the convergence probability, fit precision, and computation time, the method is particularly suitable for dealing with complex minimum problems. Author (ESRO)

N74-31436 Norwegian Defence Research Establishment, Kjeller. Div. for Electronics.

CONSTRUCTION OF SUBOPTIMAL KALMAN FILTERS BY PATTERN SEARCH

Nils Christophersen and Truls Lange-Nielsen *In* AGARD Advan. in Control Systems May 1974 6 p refs (For availability see N74-31429 21-02)

N74-32119 Joint Publications Research Service, Arlington, Va.

ANALYSIS OF ACCURACY OF MEASUREMENT OF ONE-DIMENSIONAL PLANE OF PROBABILITY OF NON-STATIONARY RANDOM PROCESS

V. A. Geranin, Y. S. Gorbenko, N. A. Mironov, and S. V. Pasechnyy *In its* Works of the second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 129-134 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 141-146 (For availability see N74-32111 21-23)

N74-32120 Joint Publications Research Service, Arlington, Va.

DETERMINATION OF NONSTATIONARIZATION ERRORS OF NONSTATIONARY RANDOM PROCESSES

G. V. Gorelova and N. G. Malyshev *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 135-139 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 147-151 (For availability see N74-32111 21-23)

N74-32121 Joint Publications Research Service, Arlington, Va.

CROSS-SPECTRUM ANALYZERS

A. K. Novikov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974

p 140-159 refs Transl. into ENGISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 152-171 (For availability see N74-32111 21-23)

N74-32126 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF NONSTATIONARY RANDOM PROCESSES
V. A. Geranin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 188-201 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 205-220 (For availability see N74-32111 21-23)

N74-32127 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL ANALYSIS OF NONSTATIONARY RANDOM PROCESSES IN THE PRESENCE OF NOISE
V. A. Geranin, A. Ya. Goncharova, N. A. Mironov, and A. N. Prodeus *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 202-208 ref Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 221-228 (For availability see N74-32111 21-23)

N74-32131 Joint Publications Research Service, Arlington, Va.
ON OPTIMIZATION OF FUNCTIONING OF HYDROACOUSTIC MEASURING SYSTEMS
G. S. Lbov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 247-259 ref Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 271-282 (For availability see N74-32111 21-23)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-32048 Freie Univ., Berlin (West Germany). Inst. for Meteorology.
METEOROLOGICAL DATA. VOLUME 135, NO. 10: RESULTS OF THE SYNOPTIC SERVICE DURING 1973. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, OCTOBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 135, HEFT 10: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1973. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 MB), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, OKTOBER]
1973 172 p refs In GERMAN
Avail: Issuing Activity

Daily and mean monthly Northern Hemisphere ground level and 500 mb height and temperature analyses of constant pressure levels for October 1973 are presented. Included scientific studies cover aspects of synoptic climatology over the Berlin sector, data on atmospheric radioactivity and dust content, and water temperature measurements in the North Atlantic.

Transl. by G.G.

N74-32049 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC WATER VAPOR FOR HIGH RESOLUTION INFRARED SPECTRA
M. Ackerman 1974 11 p refs Centre Natl. d'Etudes Spatiales and Comite sur les Consequences des Vols Stratospheriques
(Contract N00014-73-C-0076)
(Aeronomica-Acta-A-129-1974) Avail: Issuing Activity

A volume mixing ratio equal to (3.4 plus or minus 0.7) x 10 to the minus 6th power water vapor from 20 to 37 kilometers. The results were obtained by absorptiometry from a balloon platform at 40 km. Author (ESRO)

N74-32050*# Linguistic Systems, Inc., Cambridge, Mass.
ATMOSPHERIC CARBON DIOXIDE AND CLIMATE
Mikhail Ivanovich Budyko Washington NASA Aug. 1974 51 p refs Transl. into ENGLISH from Gidrometeoizdat (Leningrad), 1973 P 1-32
(Contract NASw-2482)
(NASA-TT-F-15626) Avail: NTIS HC $5.75 CSCL 04B

The influence of changes in carbon dioxide concentration on the thermal regime of the atmosphere was considered, taking into account the interrelationship between air temperature and the configuration of the polar ice. It was determined that relatively small fluctuations in the amount of carbon dioxide substantially influences climatic change on earth. The dependence found between the carbon dioxide content of the atmosphere and thermal conditions is used in discussing the laws governing climatic changes. Author

N74-32051# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
REFERENCE MATERIAL FOR COLLABORATIVE TESTS OF AIR QUALITY METHODS Final Report
Richard H. Johns and John K. Taylor Aug. 1974 19 p
(NBS-TN-840; LC-74-600123) Avail: SOD HC $0.55 as C13.46:840

Reference materials and associated distribution apparatus were developed for seven ambient air contaminants and for two smokestack contaminants. These established the reference base for collaborative tests of ASTM procedures for ambient air quality and smokestack emissions carried out under a three-year program known as Project Threshold. Author

N74-32052*# Mitre Corp., McLean, Va.
TECHNIQUES FOR ANALYZING AND UTILIZING THE RAIN GAUGES AT THE NASA WHITE SANDS TEST FACILITY Final Report
R. J. Kalagher May 1973 32 p refs
(Contract NAS5-20331)
(NASA-CR-139046; MTR-6415) Avail: NTIS HC $4.75 CSCL 14B

Ten tipping bucket rain gauges have been installed at the NASA WSTF for the purpose of determining rainfall characteristics in this area which may affect the performance of the NASA Tracking and Data Relay Satellite System. A plan is presented for analyzing and utilizing the data which will be obtained during the course of this experiment. Also included is a description of a computer program which has been written to aid in the analysis. Author

N74-32053# Scientific Translation Service, Santa Barbara, Calif.
UNITED NATIONS: ECONOMIC COMMISSION FOR EUROPE. GOVERNMENT CONSULTANTS OF CEE COUNTRIES FOR ENVIRONMENTAL PROBLEMS. WORKING GROUP ON AIR POLLUTION PROBLEMS. NATIONAL MONOGRAPH OF BELGIUM
1974 7 p Transl. into ENGLISH from Seminar on Abatement of Pollutant Emission from Non-Ferrous Metal Industry (Dubrovnik), 19 - 24 Nov. 1973 Sponsored by EPA
(TR-216-74) Avail: NTIS HC $4.00

Important data collected from a seminar on abatement of pollutant emissions from non-ferrous metal industries in Belgium is presented. The major gas and particulate pollutants are identifed, along with the broad classes of instruments that act to control them. General guidelines are also provided which indicate the types of industrial installations which must obtain authorization to continue their potentially polluting operations. Those modifications that an established authorization council is empowered to impose on non-ferrous metal processing facilities are outlined, and include such measures as modification of plant layout, the construction of chimneys, the installation of pollution control devices, and limitations on the pollutant content of effluents from factory operations. Articles of law defining governmental powers to execute pollution control standards are cited. A.A.D.

N74-32054# Scientific Translation Service, Santa Barbara, Calif.
PROTECTION OF THE PURITY OF ATMOSPHERIC AIR IN GREAT BRITAIN
V. D. Fokina [1974] 5 p refs Transl. into ENGLISH from Gigiena i Sanit. (USSR), v. 38, no. 6, Jun. 1973 p 88-89

Sponsored by EPA
(HS-131) Avail: NTIS HC $4.00

The principal sources of air pollution in Great Britain are identified, along with the negative effects on the environment and human health. Facilities presently engaging in observation and monitoring of atmospheric conditions are cited, and the history of recent British laws regarding the curbing of air pollution is outlined. Measures aimed at the use and maintenance of automobiles are discussed, including research into the development of operative and more commercially available diesel engines, and engines powered by electricity. Improvements witnessed as a result of legislative efforts are summarized.
A.A.D.

N74-32055*# Linguistic Systems, Inc., Cambridge, Mass.
ON THE ATLANTIC TROPICAL EXPERIMENT (GATE) SYNOPTIC-SCALE SUBPROGRAM
Ye. M. Dobryshman Washington NASA Aug. 1974 18 p refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 4, Apr. 1974 p 106-111
(Contract NASw-2482)
(NASA-TT-F-15695) Avail: NTIS HC $4.00 CSCL 04B

The research is reported concerning the processes of synoptic scale in the tropical regions. The development of a numerical model of tropical circulation to study the interaction of atmospheric processes is discussed along with the analysis of processes by synoptic methods.
F.O.S.

N74-32056# Defence Standards Labs., Maribyrnong (Australia).
A COMPARISON OF THE CLIMATE AT CLONCURRY WITH THE STANDARD CLIMATE OF QSTAG 200 (A2)
J. A. McRae Jun. 1974 64 p refs
(DSL-554) Avail: NTIS HC $6.25

The ambient temperatures experienced at Cloncurry have been compared with the ambient temperatures laid down in QSTAG 200 (Category A2). There is sufficient difference between the two 1% diurnal cycles to preclude any decision as to which is the more severe climate.
Author

N74-32057# Commissariat a l'Energie Atomique, Grenoble (France).
MEASUREMENTS OF POLLUTION IN THE LOWER LAYERS OF THE ATMOSPHERE
P. Perroud, M. Sylvestre-Baron, G. Pleyber, P. Perilhon, R. Faivre-Pierret, A. Closson, and C. Nicotra Jun. 1973 23 p In FRENCH Presented at the Meeting of Anti-pollution Tech., Grenoble, France, 2-6 Oct. 1973
(CEA-Conf-2487; Conf-731060-1) Avail: AEC Depository Libraries HC $3.25

The measurement of the meteorological parameters and the sampling of pollutants in the lower levels of the atmosphere were made by the use of captive balloons. A 550 M 3 airship filled with hydrogen was used with apparatus distributed along the anchor cable up to a height of 1,200 m. The meteorological probes used to measure the pressure, temperature, humidity, and wind velocity and to transmit them to the ground are described. The apparatus for air sampling and the chemical analytical methods are described. The results obtained are reported. This experiment made it possible to prove the relations existing between temperature inversion regions and pollution levels. The results show that under the temperature emission layers the profiles for the diffusion of SO2, Cl2, and organic pollutants are sharply different.
Author (NSA)

N74-32058# Commissariat a l'Energie Atomique, Grenoble (France).
USE OF CAPTIVE BALLOONS FOR THE STUDY OF THE POLLUTION IN THE LOWER LAYERS OF THE ATMOSPHERE
P. Perroud, G. Pleyber, and M. Sylvestre-Baron Sep. 1973 15 p In FRENCH Presented at the AERALL Colloq., Paris, 12-14 Nov. 1973
(CEA-Conf-2491; Conf-731138-1) Avail: AEC Depository Libraries HC $3.00

The sampling of pollutants is made with the aid of devices suspended to the anchor cable of a captive balloon. A radio-probe gives the vertical profile of the pressure, the temperature, and the humidity of the air and the vertical profile of the wind velocity. The start-up of the device is described. Some results are given which show the influence of a temperature inversion layer on the diffusion of certain pollutants.
Author (NSA)

N74-32059# European Atomic Energy Community, Luxembourg.
THE 14TH 1972 METEOROLOGICAL YEARBOOK
G. Bollini and C. Gandino Feb. 1974 67 p refs In ITALIAN Prepared in cooperation with European Atomic Energy Community, Ispra, Italy
(EUR-5067) Avail: AEC Depository Libraries HC $5.50

After a short description of the methods for measuring and elaborating atmospheric phenomena, many tables and graphics for the meteorological year 1972 are reported with english titles. With the Observatory's data, temperature and relative humidity measurements at screen No. 4, 45 meters lower, the flow of the Novellino brook and 4 tables with the stability category are added.
Author (NSA)

N74-32060# Argonne National Lab., Ill.
HANDBOOK OF AIR POLLUTANT EMISSIONS FROM TRANSPORTATION SYSTEMS
R. R. Cirillo and T. D. Wolsko Dec. 1973 180 p refs
(Contract W-31-109-eng-38)
(ANL/E-28) Avail: NTIS HC $12.00

Procedures for estimating the rate of air pollutant emissions from transportation systems are described. Emission factors and computation techniques for motor vehicles, railroad locomotives, aircraft, and waterborne vessels are presented. The major emphasis is on motor vehicle emission computations and data on model year emission rates, control device deterioration, and vehicle speed adjustments are given. Procedures for separating the cold start, computing evaporative emissions by source, and developing modewise emission factors are presented. TREFACT, a computer program designed to calculate motor vehicle emission factors, is described. Emission factors for diesel and electric railroad locomotives are presented and discussed. Aircraft emissions are described in the context of total airport emissions. Emission factors for both inboard-and outboard-powered waterborne vessels are presented.
Author (NSA)

N74-32061# Stockholm Univ. (Sweden). Inst. of Meteorology.
STABILITY FUNCTIONS FOR THE BOUNDARY LAYER RESISTANCE LAWS BASED UPON OBSERVED BOUNDARY LAYER HEIGHTS
J. W. Melgarejo and J. W. Deardorff (Natl. Center for Atmospheric Res., Boulder, Colo.) 28 Feb. 1974 36 p refs
(DM-11) Avail: NTIS HC $5.00

An empirical evaluation of the stability functions a, b, c and of the friction and heat transfer coefficients is made. The modified planetary boundary layer (PBL) similarity theory utilizes the actual height, h, of the PBL as the physical height scale for both stable and unstable cases. For this purpose, the Wangara data of Clarke et al were used. In addition, the stability parameter h/L is presented as a function of the bulk PBL Richardson number and of h/z sub o. It is found that both the average values of the stability functions and their scatter are comparable to that of the corresponding conventional functions, A, B, C which use a suitable stability parameter. Although the results favor neither method over the other, the use of h as the physical length scale enables the external variables aloft to be evaluated at the proper height.
Author (ESRO)

N74-32062# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Mar. 1974 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, MARS 1974]
Mar. 1974 15 p In FRENCH and DUTCH
Avail: NTIS HC $4.00

Meteorological parameters observed at different Belgian weather stations during March 1974 are given.
ESRO

N74-32063# World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC VAPOUR FLUX COMPUTATIONS FOR HYDROLOGICAL PURPOSES
J. P. Peixoto 1973 94 p refs
(Grant NSF-GA-1310-X)

(WMO-357: Rept-20) Avail: NTIS HC $7.75

Various physical fields, related to water vapor in the atmosphere and their importance to hydrology are discussed. The theoretical foundation of the aerological method to evaluate the hydrological cycle is discussed, with attention given to the formulation of the atmospheric water-balance equation and its interpretation. Necessary procedures to evaluate the various water vapor fields, as well as the data needed, are considered. Papers on water vapor relevant to hydrology are also reviewed. Recent developments and proposed experiments in the atmospheric water-budget approach for hydrological purposes are included. ESRO

N74-32064# Direction de la Meteorologie Nationale, Paris (France).

MEAN VALUE OF RAINFALL HEIGHT IN FRANCE, 1951-1970 [VALEUR MOYENNE DES HAUTEURS DE PRECIPITATIONS EN FRANCE, PERIODE 1951-1970]

Marcel Garnier Jan. 1974 123 p In FRENCH
(Mono-91) Avail: NTIS HC $9.25

The mean rainfall in France for 4000 stations during the period 1951 to 1970 are presented in tabular form. The means are presented by months and year for each station. Correlations with previous series show no significant differences (periods 1851 to 1900 and 1931 to 1960). Regional means are proposed. A variation coefficient is computed for 679 stations. The coefficient is slightly positive except in North and North-East regions. ESRO

N74-32065# Institut Royal Meteorologique de Belgique, Brussels.

ATMOSPHERIC POLLUTION. PRECIPITATION MEASUREMENTS USING STORAGE GAGES NETWORK OF THE INSTITUTE NATIONAL DES INDUSTRIES EXTRACTIVES Annual Report, 1972 [POLLUTION ATMOSPHERIQUE 1972. MESURE DES RETOMBEES AU MOYEN DES JAUGES DE DEPOT. RESEAU DE L'INSTITUT NATIONAL DES INDUSTRIES EXTRACTIVES (INIEX)]

1973 46 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $5.50

Results for 1972 of the first Belgian permanent control network of sedimental dust are given and pollution distribution maps shown. ESRO

N74-32066# Institut Royal Meteorologique de Belgique, Brussels.

SYNOPTIC OBSERVATIONS Monthly Bulletin, Apr. 1973 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, AVRIL 1973]

Apr. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Synoptic measurements made at different Beglian weather stations in April 1973 are given. ESRO

N74-32067# Institut Royal Meteorologique de Belgique, Brussels.

SYNOPTIC OBSERVATIONS Monthly Bulletin, May 1973 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, MAI 1973]

May 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Synoptic measurements made at different Belgian weather stations in May 1973 are given. ESRO

N74-32068# Institut Royal Meteorologique de Belgique, Brussels.

CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Feb. 1974 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, FEVRIER 1974]

Feb. 1974 15 p In FRENCH and DUTCH
Avail: NTIS HC $4.00

Meteorological parameters observed at different Belgian weather stations during February 1974 are given. ESRO

N74-32069# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

A SONIC ANEMO-THERMOMETER FOR MEASURING VERTICAL FLUXES OF SENSIBLE HEAT IN THE ATMOSPHERIC BOUNDARY LAYER [DAS ULTRASCHALL-ANEMOTHERMOMETER ALS MESSGERAET FUER DEN VERTIKALEN FLUSS FUEHLBARER WAERME IN DER BODENNAHEN LUFTSCHICHT]

Josef Lidl and Heinz Loebel 17 Jan. 1974 55 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-74-07) Avail: NTIS HC $5.75; DFVLR, Porz, West Ger. 17,30 DM

An instrument designed and developed for measurements of the turbulent fluxes of sensible heat in the atmospheric boundary layer is described. Measurements were carried out and results were obtained during long-time intervals for different weather conditions and seasons. The basic principle of the so-called sonic anemo-thermometer is the determination of the turbulent fluctuations of air temperature and vertical component of wind. A computer module in the equipment generates an output voltage proportional to the turbulent heat flux. The recording of the fluctuations and the time averages of heat flux is possible by analog as well as by digital recorder. An external digital computer may be used for signal processing and for plotting the mean values of preselected time intervals. Author (ESRO)

N74-32070# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).

VLF ATMOSPHERICS OBSERVATIONS DURING LARGE AREA CYCLONE OCCURRENCE [BEOBACHTUNGEN VON VLF-ATMOSPHERICS BEIM AUFTRETEN GROSSRAEUMIGER WIRBELSTUERME]

T. Takeuti and G. Heydt 1974 22 p refs In GERMAN
(TB-167) Avail: NTIS HC $4.25

Evaluations of measurements with VLF atmospheric analyzers, carried out in connection with several typhoons, a hurricane and a heavy storm, are presented. In all cases considered, the atmospheric production of the storms was small in comparison to that of thermal thunderstorms. An immediate warning possibility for this type of bad weather by measuring VLF atmospherics is thus not available. ESRO

N74-32071# World Meteorological Organization, Geneva (Switzerland).

AN INTRODUCTION TO AGROTOPOCLIMATOLOGY

L. B. MacHattie and F. Schnelle 1974 144 p refs
(WMO-378; TN-133) Avail: NTIS HC $10.25

The scale of agrotopoclimatology is defined with special emphasis on historical background. Aims and uses of topoclimatology are discussed; several examples from Japan are given. The elements of topoclimatology are then discussed including the special topographic configurations that have significant effects on precipitation, radiation, temperature, wind, humidity and evapotranspiration. Factors to be considered when planning and carrying out agrotopoclimatological surveys are noted and various methods described. An extensive survey of the literature on agrotopoclimatology is also included. ESRO

N74-32072# Transportation Systems Center, Cambridge, Mass.

A BIBLIOGRAPHY ON METHODS OF ATMOSPHERIC VISIBILITY MEASUREMENTS RELEVANT TO AIR TRAFFIC CONTROL AND RELATED SUBJECTS Final Report, 1901 - 1973

Hector C. Ingrao Nov. 1973 246 p refs
(AD-778499; TSC-FAA-73-26; FAA-RD-73-178) Avail: NTIS CSCL 04/2

The bibliographical survey provides reference information and background material to assist in the selection of principles and measuring techniques which may be used in the development of future systems to measure Runway Visual Range (RVR), Slant Visual Range (SVR), Approach Light Contact High (ALCH), Taxi Visual Range (TVR), or any other parameter to be defined which will describe the photometric conditions of runways and/or taxiways under actual operational and atmospheric visibility conditions. This survey gives much of the literature which has been published on the subject of visibility, the factors inherent to the target background, atmospheric optics, visibility-measuring instrumentation, photometric properties of the eye, visibility data-provessing, landing takeoff and taxiing problems which are imposed by reduced visibility. (Modified author abstract) GRA

N74-32073# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 14801 LANCE, MISSILE NO. 2196, ROUND NO. 220 APT (25 APRIL 1974)

Apr. 1974 40 p
(DA Proj. 1T6-65702-D-127)
(AD-780763; DR-833) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801 Lance, Missile Number 2196, Round Number 220 APT, are presented in tabular form. Author (GRA)

N74-32074# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12813 LANCE, MISSILE NO. 2243, ROUND NO. 225 SCT (15 MAY 1974)
May 1974 55 p
(DA Proj. 1T6-65702-D-127)
(AD-780770; DR-840) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12813 Lance, Missile Number 2243, Round Number 225 SCT, are presented in tabular form. Author (GRA)

N74-32075# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12813 LANCE, MISSILE NO. 2246, ROUND NO. 224 SCT (9 MAY 1974) Meteorological Data Report
May 1974 51 p
(DA Proj. 1T6-65702-D-127)
(AD-780769; DR-839) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12813 Lance, Missile Number 2246, Round Number 224 SCT, are presented in tabular form. Author (GRA)

N74-32076# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11602 LANCE, MISSILE NO. 2732, ROUND NO. 223 RST (7 MAY 1974) Meteorological Data Report
May 1974 52 p
(DA Proj. 1T6-65702-D-127)
(AD-780768; DR-838) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11602 Lance, Missile Number 2732, Round Number 223 RST, are presented in tabular form. Author (GRA)

N74-32077# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 15001 LITTLE JOHN, MISSILE NO. 1912, ROUND NO. 711 RS (3 MAY 1974) Meteorological Data Report
May 1974 15 p
(DA Proj. 1T6-65702-D-127)
(AD-780767; DR-837) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 15001 Little John, Missile Number 1912, Round Number 711 RS, are presented in tabular form. Author (GRA)

N74-32078# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 16201 LITTLE JOHN, MISSILE NO. 3193 ROUND NO. 719 RM (20 MAY 1974) Meteorological Data Report
May 1974 12 p
(DA Proj. 1T6-65702-D-127)
(AD-780771; DR-841) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 16201 Little John, Missile Number 3193, Round Number 719 RM, are presented in tabular form. Author (GRA)

N74-32079# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PARAMETERIZATION OF CUMULUS CONVECTION FOR INCLUSION IN A TROPICAL OPERATIONAL FORECASTING MODEL Environmental Research Papers
Louis Berkofsky 13 Feb. 1974 42 p refs
(AF Proj. 8604)
(AD-781037; AFCRL-ERP-467; AFCRL-TR-74-0089) Avail: NTIS CSCL 04/2

The equations for large-scale tropical flow, when averaged horizontally over a region large enough to contain an ensemble of clouds, include terms which represent the vertical convergence of the vertical eddy transport of sensible heat and of moisture. By assuming that these convergences are related to cumulus convection, the effect of an assumed population of cumulus clouds may be introduced into the large-scale model. The magnitude of the cumulus cloud effects must then be obtained from a cloud model, using predicted environmental parameters as input. In this investigation, the clouds are represented by a steady state plume model. Preliminary results, using assumed environmental parameters, are presented. Author (GRA)

N74-32080# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE FLORIDA WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Jun. 1974 169 p refs
(AD-781052; Rept-12-WS-TP-74-6) Avail: NTIS CSCL 04/2

A standardized procedure has been developed to determine the synoptic map types which have occurred over a specified area (window). The map type catalog is a summarization of information relating to these map types for the Florida window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. Author (GRA)

N74-32081# RAND Corp., Santa Monica, Calif.
GLOBAL CLIMATIC DATA FOR SURFACE, 800 mb, 400 mb: OCTOBER
C. Schutz and W. L. Gates Mar. 1974 197 p refs
(Contract DAHC15-73-C-0181)
(AD-780685; R-1425-ARPA) Avail: NTIS CSCL 04/2

Fourth in a series of seasonal climatic summaries, this report presents data on the primary climatic variables for the month of October. The global distributions of pressure, temperature, wind, and moisture were taken from a variety of climatological sources and formats, and reworked to show conditions at the surface, at 800 mb, and 400 mb. Also presented are the global distributions of cloudiness, planetary and surface albedo, long-wave radiation, evaporation, precipitation, and selected elements of the surface heat balance. Information is presented on a global grid of 4 deg latitude by 5 deg longitude, in the form of tables and machine-produced maps. Corresponding zonal and global averages are given. (Modified author abstract) GRA

N74-32082# Control Data Corp., Minneapolis, Minn. Research Div.
OBJECTIVE METHODS FOR LOCATING THE CENTER OF TROPICAL STORMS
D. G. Dartt, M. S. Ulstad, and R. A. Weinberg 25 Feb. 1974 37 p
(Contract N66856-3029-5500)
(AD-780772; EPRF-TR-4-74(CDC); TR-1) Avail: NTIS CSCL 04/2

Objective techniques have been developed to aid the meteorological analyst in depicting the concentric structure of tropical storms from digital satellite brightness data. The first technique consists of a linear filter which is designed to enhance concentric brightness patterns while suppressing large scale background features. A second algorithm was developed for finding the probable center of curvature among concentric brightness elements. The programs have been tested for cloud patterns from one tropical storm in various stages of development as well as for several other common patterns of actual and simulated cloud brightness. The results show that (1) enhancement of a tropical storm with a concentric filter can delineate the major concentric features of the brightness pattern, (2) a realistic center of curvature can be computed from elements of the concentric brightness pattern, and (3) the method can detect weak concentricity that may go undetected by a human analyst. Author (GRA)

N74-32083# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AIR MASSES, FRONTS AND WINTER PRECIPITATION IN CENTRAL ALASKA M.S. Thesis
Michael A. Bilello Jun. 1974 57 p refs
(DA Proj. 4A0-61102-B-52E)
(AD-780696; CRREL-RR-319) Avail: NTIS CSCL 04/2

The physical, meteorological and climatological aspects of freezing precipitation in the Tanana River Basin of Central Alaska are examined. Periods of inclement weather are evaluated with respect to frequency and duration, and concurrent temperature,

wind, atmospheric pressure and visibility conditions. Although relatively dry polar continental air masses dominate the area in winter, massive intrusions of maritime air occasionally produce a major snowstorm and, in rare instances, rain or freezing rain. Because of the surrounding mountain ranges, snow occurs most often when the atmospheric pressure is rising and the winds are from the west. Ice fogs are observed at temperatures below -21F, and very few water-droplet fogs are reported at temperatures below -31F. The relationships between air masses, fronts and local climatic influences may be used in forecasting winter precipitation in Central Alaska. The statistical survey presented also contributes new information on winter weather conditions in this region. Author (GRA)

N74-32084# Naval Weapons Lab., Dahlgren, Va.
THE ADEQUACY OF STANDARD WEATHER IN ORBIT DETERMINATION
Patrick James Fell Apr. 1974 19 p refs
(AD-780790; NWL-TR-3105) Avail: NTIS CSCL 22/3

Comparison of TRANSIT satellite orbits computed from Geoceiver observations using both real and NWL standard surface weather reveals maximum orbit differences of less than 2.0 meters. Furthermore, the introduction of refraction bias parameters into the orbit solutions can significantly increase solution accuracies. The results indicate that standard weather used in the NWL tropospheric refraction model with refraction bias parameters is adequate for orbit determination. Author (GRA)

N74-32085# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11608 LANCE, MISSILE NO. 5132, ROUND NO. 219 RTT (23 APRIL 1974) Meteorological Data Report
Apr. 1974 24 p
(DA Proj. 1T6-65702-D-127)
(AD-780762; DR-832) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11608 Lance, Missile Number 5132, Round Number 219 RTT, are presented in tabular form. Author (GRA)

N74-32086# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 16301 LITTLE JOHN, MISSILE NO. 3191, ROUND NO. 709 RM (18 APRIL 1974) Meteorological Data Report
Apr. 1974 15 p
(DA Proj. 1T6-65702-D-127)
(AD-780760; DR-830) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 16301 Little John, Missile Number 3191, Round Number 709 RM, are presented in tabular form. Author (GRA)

N74-32087# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14801/07 LANCE, MISSILE NOS. 2565/2566, ROUND NOS. 217 APT/218 APT (18 APRIL 1974) Meteorological Data Report
Apr. 1974 41 p
(DA Proj. 1T6-65702-D-127)
(AD-780761; DR-831) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801/07 Lance, Missile Numbers 2565/2566, Round Numbers 217 APT/218 APT, are presented in tabular form. Author (GRA)

N74-32088# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12809 LANCE, MISSILE NO. 2134, ROUND NO. 222 SCT (2 MAY 1974) Meteorological Data Report
May 1974 36 p
(DA Proj. 1T6-65702-D-127)
(AD-780766; DR-836) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12809 Lance, Missile Number 2134, Round Number 222 SCT, are presented in tabular form. Author (GRA)

N74-32089# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 15001 LITTLE JOHN, MISSILE NO. 1910, ROUND NO. 710 RG (30 APRIL 1974) Meteorological Data Report
Apr. 1974 16 p
(DA Proj. 1T6-65702-D-127)
(AD-780764; DR-835) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 15001 Little John, Missile Number 1910, Round Number 710 RG, are presented in tabular form. Author (GRA)

N74-32090# RAND Corp., Santa Monica, Calif.
THE ATMOSPHERIC RESPONSE TO A STRATOSPHERIC DUST CLOUD AS SIMULATED BY A GENERAL CIRCULATION MODEL
E. S. Batten Mar. 1974 24 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-780679; R-1324-ARPA) Avail: NTIS CSCL 04/2

Results of using the Rand version of the Mintz-Arakawa general circulation model to investigate the initial atmospheric response to a stratospheric dust cloud spread uniformly in a zone between twenty-five degrees north and seventy-five degrees north. The dust particles, construed to be two microns or less in diameter, have a total volume comparable to the ejecta of Krakatoa in 1883. The model was integrated for a simulated period corresponding to January and February, the results being compared with those of a control run starting with the same initial conditions and simulating the same period. The temperature below the dust cloud cooled two to three degrees and the land/ocean temperature contrasts increased. Precipitation varied as a result of changes in the circulation and moisture flux. Midlatitude Ferrel circulations were weakened; baroclinicity decreased at high latitudes and increased at low. Author (GRA)

N74-32091# RAND Corp., Santa Monica, Calif.
SUPPLEMENTAL GLOBAL CLIMATIC DATA, JANUARY
C. Schutz and W. L. Gates Dec. 1973 37 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-780676; R-915/2-ARPA) Avail: NTIS CSCL 04/2

The supplemental global distributions of sea-surface temperature, total cloud cover, planetary albedo, and outgoing long-wave radiation for January are presented as an update to all January data previously published (R-915, R-915/1). All data are presented on a global grid of four degree latitude and five degree longitude, both in the form of tabulated values and machine-analyzed maps. The corresponding zonal and global averages are also given. These data are being used at Rand as a guide for evaluating climate simulations based on the Rand version of the Mintz-Arakawa general circulation model. GRA

N74-32092# RAND Corp., Santa Monica, Calif.
SUPPLEMENTAL GLOBAL CLIMATIC DATA, JULY
C. Schutz and W. L. Gates Mar. 1974 41 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-780677; R-1029/1-ARPA) Avail: NTIS CSCL 04/2

In the supplement to R-1029, the hemispheric distributions of sea-surface temperature, total cloud cover, planetary albedo, and outgoing longwave radiation for July are extended from hemispheric to global scope. All data are presented on a global grid of four degrees latitude and five degrees longitude. They are given both in tabulations and in the form of machine-drawn maps. The corresponding zonal and global averages are also given. These data are being used as a guide for evaluating climate simulations based on the Rand version of the Mintz-Arakawa general circulation model. GRA

N74-32093# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
RESIDUAL TEMPERATURE INDUCED HUMIDITY ERRORS IN THE NATIONAL WEATHER SERVICE RADIOSONDE Final Report, Mar. 1972 - Dec. 1973
Frederick J. Brousaides and James F. Morrissey 28 Feb. 1974 38 p refs
(AD-780643; AFCRL-TR-74-0111; AFCRL-IP-215) Avail: NTIS CSCL 04/2

The principal radiosonde currently being procured for both DoD and civilian agencies was recently redesigned by the National Weather Service to incorporate improvements in the design of the humidity duct. This design incorporated the salient features of a modification previously described by the authors. These modifications were designed to minimize the errors in humidity measurement caused by the carbon humidity sensor having a temperature distinct from the ambient temperature. This is a

final report of an in-house evaluation of the efficacy of the redesign. Results are presented on the residual errors and techniques for correcting the measured humidities to remove these residuals. Author (GRA)

N74-32094# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TEST AND CALIBRATION OF THE AFCRL RAINDROP SPECTROMETER
Robert F. Myers 7 Jan. 1974 56 p refs
(AF Proj. 8620)
(AD-780649; AFCRL-TR-74-0006; AFCRL-IP-212) Avail: NTIS CSCL 04/2

The general description of the 90 degrees scattering measurements of raindrop size distribution, as implemented in the AFCRL Airborne Raindrop Spectrometer, is given. The calibration procedures for the drop generator show long-time stability of the order of 01 mm drop diameter. The techniques for calibrating the spectrometer are described with the information required for data reduction. Calibration data for the simple current-to-voltage transducer and for a signal processor which removes the background illumination signal and stretches the drop pulse are presented. Author (GRA)

N74-32095# Research Triangle Inst., Durham, N.C.
COST OF MONITORING AIR QUALITY IN THE UNITED STATES
A. K. Miedema, C. E. Decker, F. Smith, and J. White Dec. 1973 93 p refs
(Contract EPA-68-02-1096)
(PB-231169/4; EPA-450/3-74-029) Avail: NTIS HC $7.75 CSCL 13B

Two sets of aggregate national air quality monitoring costs are estimated. The first set projects the costs of implementing the minimum federal air quality surveillance requirements. The second set projects costs of implementing the state-proposed networks. Analysis of portable and automated air quality monitoring stations indicate that telemetric stations are less costly than logging systems. An extensive table of costs for each state is included. GRA

N74-32096# RAND Corp., Santa Monica, Calif.
GLOBAL CLIMATIC DATA FOR SURFACE, 800 mb, 400 mb: APRIL
C. Schutz and W. L. Gates Dec. 1973 197 p refs
(Contract DAHC15-73-C-0181)
(AD-780680; R-1317-ARPA) Avail: NTIS CSCL 04/2

The April global distributions of pressure, temperature, wind, and moisture have been taken from a variety of climatological sources and formats, for reconstruction at the surface, 800 mb, and 400 mb to facilitate comparison with integrations from the Mintz-Arakawa two-level model. These data are supplemented by presentations of the global distributions of cloudiness, planetary and surface albedo, long-wave radiation, evaporation, precipitation, and selected elements of the surface heat balance. All data are presented on a global grid of 4 degrees latitude by 5 degrees longitude, in the form of both tabulated values and machine-analyzed maps. The corresponding zonal and global averages are also given. (Modified author abstract) GRA

N74-32097# National Climatic Center, Asheville, N.C.
US NAVAL WEATHER SERVICE COMMAND SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. EAST AFRICAN AND SELECTED ISLAND COASTAL MARINE AREAS. VOLUME 2: AREA 7, RED SEA SOUTH, AREA 8, RED SEA SOUTH CENTRAL, AREA 9, RED SEA CENTRAL, AREA 11, RED SEA NORTH CENTRAL, AREA 11, RED SEA NORTH, AREA 12, GULF OF SUEZ
Jun. 1974 485 p refs
(AD-780662) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-32098*# Aerospace Corp., El Segundo, Calif. Mission Analysis Dept.
DESCRIPTION OF THE ATTITUDE CONTROL, GUIDANCE AND NAVIGATION SPACE REPLACEABLE UNITS FOR AUTOMATED SPACE SERVICING OF SELECTED NASA MISSIONS
V. A. Chobotov 5 Apr. 1974 42 p
(Contract NASw-2575)
(NASA-CR-139589; ATR-74(7341)-1) Avail: NTIS HC $5.25 CSCL 17G

Control elements such as sensors, momentum exchange devices, and thrusters are described which can be used to define space replaceable units (SRU), in accordance with attitude control, guidance, and navigation performance requirements selected for NASA space serviceable mission spacecraft. A number of SRU's are developed, and their reliability block diagrams are presented. An SRU assignment is given in order to define a set of feasible space serviceable spacecraft for the missions of interest. Author

N74-32099*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
EVALUATION OF SELECTED STRAPDOWN INERTIAL INSTRUMENTS AND PULSE TORQUE LOOPS, VOLUME 1 Final Report
J. S. Sinkiewicz, J. Feldman, and C. B. Lory Jul. 1974 124 p refs
(Contract NAS12-2033)
(NASA-CR-120427; R-826-Vol-1) Avail: NTIS HC $9.25 CSCL 17G

Design, operational and performance variations between ternary, binary and forced-binary pulse torque loops are presented. A fill-in binary loop which combines the constant power advantage of binary with the low sampling error of ternary is also discussed. The effects of different output-axis supports on the performance of a single-degree-of-freedom, floated gyroscope under a strapdown environment are illustrated. Three types of output-axis supports are discussed: pivot-dithered jewel, ball bearing and electromagnetic. A test evaluation on a Kearfott 2544 single-degree-of-freedom, strapdown gyroscope operating with a pulse torque loop, under constant rates and angular oscillatory inputs is described and the results presented. Contributions of the gyroscope's torque generator and the torque-to-balance electronics on scale factor variation with rate are illustrated for a SDF 18 IRIG Mod-B strapdown gyroscope operating with various pulse rebalance loops. Also discussed are methods of reducing this scale factor variation with rate by adjusting the tuning network which shunts the torque coil. A simplified analysis illustrating the principles of operation of the Teledyne two-degree-of-freedom, elastically-supported, tuned gyroscope and the results of a static and constant rate test evaluation of that instrument are presented. Author

N74-32100*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
STANDARDIZED STRAPDOWN INERTIAL COMPONENT MODULARITY STUDY, VOLUME 2 Final Report
Julius Feldman Jul. 1974 60 p
(Contract NAS12-2033)
(NASA-CR-120428; R-826-Vol-2) Avail: NTIS HC $6.00 CSCL 17G

To obtain cost effective strapdown navigation, guidance and stabilization systems to meet anticipated future needs a standardized modularized strapdown system concept is proposed. Three performance classes, high, medium and low, are suggested to meet the range of applications. Candidate inertial instruments are selected and analyzed for interface compatibility. Electronic packaging and processing, materials and thermal considerations applying to the three classes are discussed and recommendations advanced. Opportunities for automatic fault detection and redundancy are presented. The smallest gyro and accelerometer modules are projected as requiring a volume of 26 cubic inches

and 23.6 cubic inches, respectively. Corresponding power dissipation is projected as 5 watts, and 2.6 watts respectively. Author

N74-32101# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
GENERATION OF HIGH PRECISION CURRENT-TIME-INCREMENTS FOR THE PULSE REBALANCE LOOP OF SENSORS
Dietrich Rahlfs 1974 103 p refs In GERMAN; ENGLISH summary
(DLR-FB-74-08) Avail: NTIS HC $8.25; DFVLR, Porz, West Ger. 20 DM

Pulse rebalancing loops allow the digital readout of sensors with high resolution. A comparison of different rebalancing methods is made. The circuity for the binary pulse width modulation rebalancing loop is described. The errors which degrade the generation of high precision current-time-pulses are investigated. With the described electronic circuits a stability of 1 ppm/h per pulse is achieved. Author (ESRO)

N74-32102# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DESIGN OF OPTIMAL AND SUBOPTIMAL STATE-ESTIMATORS UNDER REGULARITY DEFECTS
Winfried Hofmann and Willi Kortuem 23 Jan. 1974 88 p refs
(DLR-FB-74-13) Avail: NTIS HC $7.50; DFVLR, Porz, West Ger. 29.20 DM

The analysis and the design of state-estimators for continuous linear dynamic systems under regularity defects are presented. The regularity conditions are reviewed and their influence on the estimator behavior and design is discussed. The derivation of reduced-order estimators for noise-free and/or correlated-noise measurements is simplified, resulting in some numerical advantages and a complex set of regularity conditions. Also, estimators based on kinematic modeling are presented for (rotational) dynamic problems. The theoretical results are applied to some typical examples of spacecraft attitude determination and aided inertial navigation systems. Author (ESRO)

N74-32103# Stanford Research Inst., Menlo Park, Calif.
LORAN PROPAGATION
S. M. Berman Apr. 1974 23 p refs
(Contract DAHC15-73-C-0370; SRI Proj. 3000)
(AD-780189; SRI-JSR-73-7) Avail: NTIS CSCL 17/7

The possibility of using position independent weighted averages of phase and signal arrival times to eliminate the corrections in these times caused by intervening media is examined for the case of loran C ground waves. Three analytically simple examples are considered-short, longitudinal, homogeneous paths; longitudinal paths with one inhomogeneity; and first-order corrections to longitudinally homogeneous paths taking into account the sphericity of the earth. In each of these cases suitable weighted averages can be made in which one unknown such as the media conductivity can be eliminated. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-32104*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED DESIGN CONCEPTS IN NUCLEAR ELECTRIC PROPULSION
M. L. Peelgren and J. F. Mondt 1 Aug. 1974 90 p refs
(Contract NAS7-100)
(NASA-CR-139635; JPL-TM-33-664) Avail: NTIS HC $7.50 CSCL 21F

Conceptual designs of the nuclear propulsion programs are reported. Major areas of investigation were (1) design efforts on spacecraft configuration and heat rejection subsystem, (2) high-voltage thermionic reactor concepts, and (3) dual-mode spacecraft configuration study. Author

N74-32105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUCLEAR ELECTRIC PROPULSION STAGE REQUIREMENTS AND DESCRIPTION
J. F. Mondt, M. L. Peelgren, A. M. Nakashima, T. M. Nsieh, W. M. Phillips, and G. M. Kikin 1 Aug. 1974 71 p refs
(Contract NAS7-100)
(NASA-CR-139636; JPL-TM-33-647) Avail: NTIS HC $6.75 CSCL 21F

The application of a nuclear electric propulsion (NEP) stage in the exploration of near-earth, cometary, and planetary space was discussed. The NEP stage is powered by a liquid-metal-cooled, fast spectrum thermionic reactor capable of providing 120 kWe for 20,000 hours. This power is used to drive a number of mercury ion bombardment thrusters with specific impulse in the range of 4000-5000 seconds. The NEP description, characteristics, and functional requirements are discussed. These requirements are based on a set of five coordinate missions, which are described in detail. These five missions are a representative part of a larger set of missions used as a basic for an advanced propulsion comparison study. Additionally, the NEP stage development plan and test program is outlined and a schedule presented. Author

N74-32106# Los Alamos Scientific Lab., N.Mex.
MASS SPECTROMETRIC DETERMINATION OF O-18/O-16 RATIOS TO LOCATE THE SOURCE OF OXYGEN IN SNAP FUEL CAPSULE COMPONENTS
M. E. Smith and G. R. Waterbury Feb. 1974 3 p refs
(Contract W-7405-eng-36)
(LA-5489) Avail: NTIS HC $4.00

The successful application of a mass spectrometric method to determine the source of oxygen diffusion into the container material of a radioisotopic fuel capsule is described. The source was chiefly the oxide fuel ($Pu-238O_2$) and not the atmosphere. This could be accomplished by determining the O-18/O-16 ratio in the tantalum alloy material, because the O-18 content of the fuel had been reduced to minimize alpha-n reactions. The O-18/016 ratio was approximately 0.00055 for fuel as compared with 0.002 for air. The radiochemical method, based on an alpha-n reaction, could not be applied because of the very low alpha-particle flux in the liner material. Author (NSA)

N74-32107# Technische Hochschule, Hanover (West Germany).
COMPARISON OF MODULE METHOD WITH AN INTEGRATED MONTE CARLO METHOD IN CALCULATING RADIATION TRANSPORT IN COMPARTMENT WALLS [VERGLEICH DER MODUL-METHODE MIT EINER INTEGRALEN MONTE-CARLO-METHODE BEI DER BERECHNUNG DES STRAHLUNGSTRANSPORTES IN DEN WAENDEN EINES COMPARTMENTS]
A. Falk, S. Reimann, and C.-D. Wueneke Bonn Bundeswehramt 1973 120 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-40) Avail: NTIS HC $9.00; Bundeswehramt 40 DM

Two mathematical methods for calculating the radiation transport through compartment walls were compared. The methods are a combination of Monte Carlo and module method, and an integral Monte Carlo method as used in the SPARC-COMBINE and UNC-SAM program systems. The comparison was made using results for practical models. In this comparison, some deviations were observed, which can probably be explained from the use of different data sets for the interaction probabilities. In most cases, the deviations are based on differences between the methods and model assumptions. ESRO

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-32108*# Martin Marietta Aerospace, Denver, Colo. Space Physics Lab.
STUDY OF X-RAY OPTICS Final Report
Joseph F. Froechtenigt Nov. 1973 12 p refs
(Contract NAS8-29861)
(NASA-CR-139587; MCR-73-317) Avail: NTIS HC $4.00 CSCL 20N

The testing is reported of a polished Kanigen coated beryllium mirror in a soft X-ray telescope to be flown on a Skylark sounding rocket. This test involved inserting the telescope in a 220 foot long vacuum line and taking photographs of an X-ray resolution source. These photographs were then used to evaluate the performance of the telescope mirror as a function of distance from the focal plane and the angular distance off the telescope axis. A second test was made in which a point source was used to study the imaging characteristics by means of a pinhole and proportional counter placed in the telescope focal plane. A third test was conducted using a position sensitive detector. The efficiency and resolution was increased by polishing. Author

N74-32109*# Arkansas Univ., Little Rock. Graduate Inst. of Technology.
THE EFFECT OF HIGH TEMPERATURE UPON THE TRANSMITTANCE AND THE EMISSION SPECTRUM OF INFRARED WINDOW MATERIALS Final Technical Report
M. K. Testerman, G. S. Ballard, and C. D. McKean 1 Aug. 1974 43 p refs
(Grant NGL-04-001-007)
(NASA-CR-139583) Avail: NTIS HC $5.25 CSCL 20F

The effect of high temperatures such as those expected to be encountered in the Pioneer Venus Probe mission upon the transmittance of zinc selenide and cadmium telluride infrared window materials was investigated and the radiation emitted by these materials at high temperatures was determined. Author

N74-32110# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ATTENUATION AND DISPERSION OF SOUND IN A DROPLET-LADEN GAS-MIXTURE
Manfred Jaeschke Jul. 1974 22 p refs Presented at 8th Intern. Congr. on Acoustics, London, 23-31 Jul. 1974
(Ber-5/1974) Avail: NTIS HC $4.25

A theoretical formulation of the attenuation of sound in a droplet laden gas mixture is developed. This formulation can also be applied to submicroscopic droplets in the r approximately 0.01 range. Results are compared with experimental micrometer data for the same range of droplet radii. The experiments yield energy attenuation coefficients of 10 m/1 = 43.4 db/m. They are two orders of magnitude larger than the values formerly measured or calculated. The acoustic energy decreases to one-half after a propagation length of 10 cm under above experimental conditions. Author

N74-32111# Joint Publications Research Service, Arlington, Va.
WORKS OF THE SECOND ALL-UNION SCHOOL-SEMINAR ON STATISTICAL HYDROACOUSTICS
N. G. Zagoruyko, ed., V. V. Olshevskiy, ed., and V. Ya. Rozenberg, ed. 31 Jul. 1974 302 p refs Transl. into ENGLISH of the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 1-296
(JPRS-62622) Avail: NTIS HC $18.25

Descriptions of various statistical hydroacoustic recognition systems and methods are reported. For individual titles, see N74-32112 through N74-32135.

N74-32112 Joint Publications Research Service, Arlington, Va.
WAVE GUIDE MOLECULES OF HYDROACOUSTIC FIELDS IN WAVE GUIDES WITH STATISTICALLY IRREGULAR BOUNDARIES
V. M. Kudryashov *In its* Works on the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 1-25 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 3-31 (For availability see N74-32111 21-23)

A mathematical model is formulated that describes the effect of scattering on the statistically rough boundary of a hydroacoustic wave guide field during superlong range propagation of sound through a channel. The statistically coherent field of the uneven boundary is considered equivalent to an impedance plane with some effective reflectivity, which takes into consideration losses in scattering. G.G.

N74-32113 Joint Publications Research Service, Arlington, Va.
ON THE PROBLEM OF FIELD REPRESENTATION BY THE SAMPLING METHOD
S. A. Voytsekhovskaya, Yu. L. Kaydanov, and V. A. Saprykin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 26-45 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 32-52 (For availability see N74-32111 21-23)

A hydroacoustic field is represented through its values at a priori known points with the aid of a known restoring function. Considered is a field that possesses axial symmetry and whose spectrum is given by a finite function with the carrier in the form of a n-dimensional sphere, the center of which is located at the coordinate origin. G.G.

N74-32114 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE DEPENDENCE OF UNDERWATER OCEAN NOISE ON WIND VELOCITY
V. I. Bardyshev, S. G. Gershman, A. M. Velikanov, and V. I. Kryshniy *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 46-52 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 53-59 (For availability see N74-32111 21-23)

It is established that slow variations of underwater noise levels are comparatively synchronous on sonic and infrasonic frequencies and correlate with the variations of wind velocity. The wind apparently plays an important role in the generation of underwater noises in the ocean on infrasonic and sonic frequencies. Sources of noise that do not correlate with the wind also contribute on frequencies below 100 Hz. These apparently are noises and pseudonoises of underwater currents and distant ships. That seismic low frequency noises also play a certain role is not excluded. Author

N74-32115 Joint Publications Research Service, Arlington, Va.
ON THE CHARACTERISTIC FUNCTIONALS OF CERTAIN HYDROACOUSTIC FIELDS
V. I. Klyachkin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 53-82 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 60-90 (For availability see N74-32111 21-23)

Analytical mechanics of stochastic wave fields are considered in formulating general relations that connect the distribution functions of a random hydroacoustic field to the distribution functions of the sources that generate the given field. The method of characteristics functionals generalizes the concept of a multidimensional characteristics function for a random vector field. G.G.

N74-32116 Joint Publications Research Service, Arlington, Va.
STATISTICAL PROPERTIES OF EMISSION FIELDS OF ELASTIC SYSTEMS **c32**
G. I. Usoskin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 82-93 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 91-02 (For availability see N74-32111 21-23)

Analysis of statistical properties of the emission fields of elastic systems, especially plates and shells, acted upon by random external forces, is very important for the solution of hydroacoustic problems. In this connection methods of calculating the statistical characteristics of such fields are examined and the structure of the emission fields of an infinite plate and cylindrical shell is

analyzed below. In addition, systems consisting of several shells, the vibrations of which are connected through the medium, are examined. Author

N74-32117 Joint Publications Research Service, Arlington, Va.
ADAPTIVE METHODS OF MEASURING COORDINATES OF SIGNAL SOURCES
A. M. Zufrin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 94-119 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 103-130 (For availability see N74-32111 21-23)

Synthesis of an optimal adaptive trajectory meter requires the following considerations for a statistical solution: (1) Limitations of the energy potential; (2) limitations introduced by systems of communication with the media; (3) limitations imposed by the parameters of the signal source; and (4) limitations with respect to adaptation time. Author

N74-32118 Joint Publications Research Service, Arlington, Va.
PROBLEMS IN THE THEORY OF STATISTICAL MEASUREMENTS IN HYDROACOUSTICS
V. V. Olshevskiy and E. I. Tsvetkov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 120-128 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 131-140 (For availability see N74-32111 21-23)

The following procedure is used for measuring two dimensional moving statistical characteristics of nonstationary and nonergodic acoustic random processes. Analysis of the finite set of initial realizations of finite length and a priori information concerning the properties of the process are combined to develop its mathematical model, and consequently a method of synthesizing hypothetical groups. Through hypothetical groups it is possible to determine the properties of estimation and, in accordance with the assumed quality criterion, to develop methods of optimizing the measurement procedures. Author

N74-32119 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF ACCURACY OF MEASUREMENT OF ONE-DIMENSIONAL PLANE OF PROBABILITY OF NONSTATIONARY RANDOM PROCESS **c19**
V. A. Geranin, V. S. Gorbenko, N. A. Mironov, and S. V. Pasechnyy *In its* Works of the second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 129-134 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 141-146 (For availability see N74-32111 21-23)

Systems analysis on the laws of distribution for nonstationary random processes is used to determine measurement errors in a one-dimensional plane of probability of a nonstationary ergodic random process in signal detection against a background of noise, etc. G.G.

N74-32120 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF NONSTATIONARIZATION ERRORS OF NONSTATIONARY RANDOM PROCESSES **c19**
G. V. Gorelova and N. G. Malyshev *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 135-139 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 147-151 (For availability see N74-32111 21-23)

The problem of stationarization of the process of measurement of developing sea wind wave action is examined and an attempt is made on the basis of experimental results, to evaluate certain errors that occur in this connection. Since the process of sea wind/wave interaction is nonstationary, both in space and time, its reduction to a stationary action requires evaluation of the numerical characteristics and the laws of distribution for nonstationary processes. Stationarization is accomplished by representing the nonstationary random process as the product of a stationary process and some nonrandum correlation function. G.G.

N74-32121 Joint Publications Research Service, Arlington, Va.
CROSS-SPECTRUM ANALYZERS **c19**
A. K. Novikov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 140-159 refs Transl. into ENGISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 152-171 (For availability see N74-32111 21-23)

Cross spectral measurements are used instead of correlation measurements for determining the spectra of noise produced by several sources of sound during simultaneous operation of several sources. Examples of the recording of cross spectra are described. Author

N74-32122 Joint Publications Research Service, Arlington, Va.
GENERALIZED MODEL OF SIGNAL DETECTOR. ANALYSIS AND SYNTHESIS OF DETECTORS FOR SIGNALS WITH A PRIORI UNKNOWN FORM
I. M. Strelkov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 160-176 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 160-176 (For availability see N74-32111 21-23)

General concepts are reported for the construction and analysis of a detector model that bridges the gap between strictly optimum detectors and those that are used in practice. The introduction of this model in the theory of signal detection makes it possible to design detectors for an extremely arbitrary volume of a priori information about the noise and signals intended for detection. An analysis of the noise immunity for detectors of the classes O sub 2i,1 in application to Gaussian noise and monochromatic Gaussian signals is resulted. Author

N74-32123 Joint Publications Research Service, Arlington, Va.
ON ESTIMATION OF THE VELOCITY OF SCATTERERS BY MEASURING THE FREQUENCY SPECTRUM OF SEA REVERBERATION
V. I. Paderno and A. I. Paderno *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 177-180 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 192-196 (For availability see N74-32111 21-23)

The effect of chaotic motion of scatterers on the frequency spectrum of sea reverberation is studied. The summary effect of reverberation, perceived by the receiving antenna, is a set of elementary scattered signals, displaced relative to each other in terms of frequency. This displacement is a result of the different velocities of the scatterers in relation to the transceiving acoustic antenna, which leads to different magnitudes of Doppler shifts of the elementary scattered signals. The frequency bandwidth of the summary reverberation signal is a function of the central frequency of the radiated signal, of the frequency band occupied by it, and of the law of distribution for the velocities of the scatterers. Author

N74-32124 Joint Publications Research Service, Arlington, Va.
ON FLUCTUATIONS OF ENVELOPES OF SEA REVERBERATION DURING LONG TONAL TRANSMISSION
I. V. Yemelyanenko, Ye. S. Libenson, and A. I. Paperno *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 181-183 ref Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 197-199 (For availability see N74-32111 21-23)

Reverberation measurements were conducted in regions of the sea at depths from 3000-3500 m. The sound velocity distribution was characterized by the presence of an underwater acoustic channel with the axis at a depth of about 100 m. Statistical analysis on reverberation envelope recordings of tonal transmissions up to 10 s duration shows little correspondence between fluctuation interval correlation with pulse duration and distances to scattering regions. Author

N74-32125 Joint Publications Research Service, Arlington, Va.
CORRELATION CHARACTERISTICS OF REVERBERATION

V. B. Nalgachev, S. P. Rokotov, and I. I. Shilovich *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 184-187 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 200-204 (For availability see N74-32111 21-23)

During analysis of the statistical and energy properties of sea reverberations it is essential to know the causes of scattering of sound and to classify the reverberation process. The dependence of the autocorrelation interval on time is used for distinguishing between boundary and spatial reverberation; the character of this dependence determines the contribution of each form of reverberation to the overall process. Author

N74-32126 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF NONSTATIONARY RANDOM PROCESSES **c19**

V. A. Geranin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 188-201 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 205-220 (For availability see N74-32111 21-23)

The known treatments of the stated parameters of continuous NSP are discussed and a generalization of the spectral representations to the case of lattice NSP is proposed. Familiar and new relations between like response parameters and actions in linear continuous and pulse deterministic systems are presented. They are used as a basis for evaluation of the features and advantages of various definitions of the examined parameters. Author

N74-32127 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL ANALYSIS OF NONSTATIONARY RANDOM PROCESSES IN THE PRESENCE OF NOISE **c19**

V. A. Geranin, A. Ya. Goncharova, N. A. Mironov, and A. N. Prodeus *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 202-208 ref Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 221-228 (For availability see N74-32111 21-23)

The effects of additive in multiplicative nonstationary random noise on the accuracy and dispersion of nonstationary random process noise measurements are discussed. Author

N74-32128 Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS IN THE THEORY OF HIERARCHICAL RECOGNITION SYSTEMS IN APPLICATION TO PROCESSING OF HYDROACOUSTIC SIGNALS

G. Ya. Voloshin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 209-224 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 229-246 (For availability see N74-32111 21-23)

Hierarchical recognition systems or algorithms in combined hydroacoustic research with automatic pattern recognition methods are discussed. To ensure a minimum loss risk, all available a priori information is expressed in terms of a priori probabilities of patterns, a matrix of penalties for false recognition, and the cost of experiments. Author

N74-32129 Joint Publications Research Service, Arlington, Va.
METHODS OF MEASURING SIGNAL TO NOISE RATIO

G. M. Makhonin, A. N. Orlichenko, and V. P. Ryzhov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 225-238 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 247-262 (For availability see N74-32111 21-23)

The signal to noise ratio is used in statistical hydroacoustics to measure the following signal properties: (1) One dimensional characteristics; (2) correlation or spectral characteristics; (3) multidimensional characteristics; (4) degree of nonstationary; and (5) set of indices. The choice of the measurement method depends on a priori information about the properties of signal and noise. G.G.

N74-32130 Joint Publications Research Service, Arlington, Va.
SPACE-TIME OPTIMUM PROCESSING FOR SIGNAL WITH FLUCTUATING AMPLITUDE

N. G. Gatkin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 239-246 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 263-270 (For availability see N74-32111 21-23)

The space-time correlation function and the mathematical expectation of the signal to noise mixture are used to determine the structure of a hydroacoustic receiver for optimal processing of fluctuating amplitude signals in the presence of multiplicative and additive noise. G.G.

N74-32131 Joint Publications Research Service, Arlington, Va.
ON OPTIMIZATION OF FUNCTIONING OF HYDROACOUSTIC MEASURING SYSTEMS **c19**

G. S. Lbov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 247-259 ref Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 271-282 (For availability see N74-32111 21-23)

An algorithm for optimization of complex systems is proposed that may be useful in the various stages of the design of optimum hydroacoustic systems, and also for optimization of their functioning under changing environmental conditions. Author

N74-32132 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF TURBULENCE CHARACTERISTICS BY OPTICAL METHODS

A. M. Trokhan *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 260-272 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 283-297 (For availability see N74-32111 21-23)

Existing optical measurement methods for evaluating statistical hydroacoustic turbulence characteristics are reported. Considered are: diffusion-, densitometric-, acoustic-, and anemometric - measurements. G.G.

N74-32133 Joint Publications Research Service, Arlington, Va.
SIGNAL DETECTION WITH INCOMPLETE A PRIORI INFORMATION ABOUT NOISE CORRELATION FUNCTION

L. G. Krasnyy *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 273-278 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 298-304 (For availability see N74-32111 21-23)

The synthesis of an optimum receiver for processing a radio signal against a background of noise by a correlation function is reported. Proposed is an adaptive parametric detector that stabilizes a non-parametric criterion when the distribution of noise changes. G.G.

N74-32134 Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS OF MEASUREMENTS IN A PROBLEM OF SOUND PATTERN RECOGNITION

A. M. Reznik *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 279-286 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 305-313 (For availability see N74-32111 21-23)

The problem of an abbreviated description for sound realization is solved by using individual fragments that completely describe a nonspecific acoustic process as additional information. The description of the set of sounds includes a set of parameters characteristic for the specific aspect of the recognition problem as well as an operator that corrects this description in consideration of additional information. Neurophysiological and cybernetic models for construction of the auditory analyzer are elaborated,

and a computerized simulation of a neuron system with a potential field of stimulation is formulated. G.G.

N74-32135 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF CLIPPING DETECTORS IN PRESENCE OF CORRELATED NOISE
I. P. Yudenkov *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 287-296 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 314-324 (For availability see N74-32111 21-23)

The statistical hydroacoustic problem is studied of detecting a noise signal received in a noise field through N channels by means of an array of N hydrophones. It is shown that the advantages of clipping receivers with so-called nonparametric reception remain in force in real correlated noise fields. G.G.

N74-32136# Joint Publications Research Service, Arlington, Va.
TOPICS OF REPORTS OF THE THIRD ALL-UNION SEMINAR ON STATISTICAL HYDROACOUSTICS
V. V. Olshevskiy, ed. and V. Ya. Rozenburg, ed. 25 Jul. 1974 302 p refs Transl. into ENGLISH of the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 1-350
(JPRS-62571) Avail: NTIS HC $18.25

A collection of materials on various aspects of statistical hydroacoustics including mathematical modeling of random fields and media, statistical measurements, and experimental research data is presented. For individual titles, see N74-32137 through N74-32167.

N74-32137 Joint Publications Research Service, Arlington, Va.
CORRELATION CHARACTERISTICS OF THE WAVE FIELD OF A NONMONOCHROMATIC RADIATION SOURCE IN MEDIA WITH RANDOM PARAMETERS
E. P. Gulin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 2-14 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 4-20 (For availability see N74-32136 21-23)

On the basis of the theory of linear filters some general relations are presented for channels with random parameters. They permit calculation of the correlations in the wave field being given the specific models of the channels and types of signals. As examples two models of channels with random parameters were considered: space filled with large scale volumetric nonuniformities, and a uniform halfspace bounded by an uneven surface with gently sloping unevennesses. For both models of the channels and certain types of signals the space-time correlation of the wave field and the mutual correlation between the initial radiation and the wave field at some point in space were calculated. The investigation was carried out for an arbitrary scalar wave field. The results obtained are applicable, in particular, also to hydroacoustic signals and in certain cases when the polarization effects do not play a significant role, they are valid for the electromagnetic wave field. Author

N74-32138 Joint Publications Research Service, Arlington, Va.
CORRELATION AND DIRECTIONAL PROPERTIES OF THE FIELDS OF NONSTATIONARY NONUNIFORM SOURCES
V. B. Galanenko and M. I. Karnovskiy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 15-34 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 21-30 (For availability see N74-32136 21-23)

The fields of two and three-dimensional sources for which the movement of the surface (or volume) elements is described by the nonuniform nonstationary random function were investigated. Models of such sources are described and discussed. Author

N74-32139 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF MARINE REVERBERATION WITH MUTUAL CORRELATION PROCESSING
V. V. Olshevskiy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 35-47 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 46-60 (For availability see N74-32136 21-23)

A study was made of the joint time-frequency correlation characteristics of the emitted signal and the reverberation under the assumption of a discrete model of scattering of the sound waves on the nonuniformities of the wave environment and its boundaries. The effect of the type of emitted signal on the indicated characteristics was also analyzed. A.L.

N74-32140 Joint Publications Research Service, Arlington, Va.
RESULTS OF THE EXPERIMENTAL STUDY OF THE STATISTICAL CHARACTERISTICS OF REVERBATION SIGNALS IN RIVER WATER
A. N. Yakovlev *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 48-54 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 61-68 (For availability see N74-32136 21-23)

Results of the statistical processing of the oscillograms of river reverberation signals were analyzed. Information is presented about its statistical and energy properties, and relations are discussed for the backscatter coefficients as a function of certain factors based on the specific characteristics of the river water. Author

N74-32141 Joint Publications Research Service, Arlington, Va.
PROBLEM OF THE PECULIARITIES OF THE WAVE MODEL OF A SOUND FIELD IN THE SHADOW ZONE
V. M. Kudryashov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 55-61 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 69-76 (For availability see N74-32136 21-23)

A study was made of the problem of the sound field of a harmonic source placed in a plane-stratified liquid medium filling a space. Author

N74-32142 Joint Publications Research Service, Arlington, Va.
STATISTICAL MODEL OF THE OCCURRENCE AND COURSE OF HYDRODYNAMIC CAVITATION AND ACOUSTIC-HYDRODYNAMIC PHENOMENA
V. I. Ilichev *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 62-81 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 77-100 (For availability see N74-32136 21-23)

The statistical model of the occurrence and development of hydrodynamic cavitation permits approximate solution of a series of quantitative and qualitative descriptions of various forms of cavitation: (1) the relation and frequency of formation of the cavitation caverns to the flow parameters and the parameters of the streamlined body; (2) the distribution law of the time intervals between the caverns; (3) the relation of the critical velocity of occurrence of the cavitation to the parameters of the body and flow; (4) discovery of the dependence of the intensity of the cavitation noise and spectral density on the gas content of the water, the flow velocity, the size of the body, the stage of cavitation, and other parameters; (5) determination of the frequency of the cavitation maxima in the cavitation noise spectra; and (6) explanation of the distribution of the amplitude and frequency modulation with respect to frequency bands of the cavitation noise. Author

N74-32143 Joint Publications Research Service, Arlington, Va.
NOISE MODULATION DURING HYDRODYNAMIC CAVITATION
V. P. Lesunovskiy and Yu. V. Khokha *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-

62571) 25 Jul. 1974 p 82-89 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 101-108 (For availability see N74-32136 21-23)

An analysis of elementary information shows that the cavitation noise can be considered as the pulse random process in which the amplitude, duration, form, and also time intervals between the successive pulses are random variables. In individual cases the cavitation noise in the sound and ultrasound frequency range turns out to be modulated with respect to amplitude and phase (frequency) by low frequency deterministic processes. The latter are connected with the quasiperiodic pulsations of average pressure commensurate with the velocity head in the case of poorly streamlined bodies, and in the case of propellers, with rotation of the propeller. It is emphasized that the problems connected with modulation of the cavitation noise are of significant interest since the study of the envelope permits in certain cases information to be obtained about the parameters of motion of the hydrodynamic system. Author

N74-32144 Joint Publications Research Service, Arlington, Va.
TRANSMISSION HYDROACOUSTIC INFORMATION UNDER THE CONDITIONS OF MULTIBEAM PROPAGATION
K. I. Malyshev *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 90-96 refs Transl. into ENGLISH from the Book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 109-116 (For availability see N74-32136 21-23)

Although the hydroacoustic communications channel is among the channels with multibeam signal propagation, the problems of optimal transmission of discrete hydroacoustic information are solved usually without considering the multibeam nature of the channel which leads to distortion of the received signals and, in the final analysis, a reduction in the reliability of the information transmission. Inasmuch as the transmitted signal reaches the receiver along all beams, there is the possibility of using this fact to increase the reliability of information transmission in a multibeam communications channel by comparison with a single beam channel. Estimates are presented of the noiseproofness of the widest spread binary communication systems with wideband signals under the conditions of invariant multibeamed nature. Author

N74-32145 Joint Publications Research Service, Arlington, Va.
OPTIMAL METHODS OF SPACE-TIME PROCESSING OF AN ADDITIVE MIXTURE OF DETERMINISTIC AND RANDOM SIGNALS AGAINST A BACKGROUND OF NOISE WITH AN ARBITRARY DISTRIBUTION LAW
N. G. Gatkin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 97-112 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 117-134 (For availability see N74-32136 21-23)

In order to illustrate the general approach to the problem of detection according to the theory of finding the optimal form of the receiver (the optimal functional), the problem of signal detection against a background of gaussian noise was investigated. Author

N74-32146 Joint Publications Research Service, Arlington, Va.
STATISTICAL ANALYSIS OF RANDOM SOUND FIELDS
V. B. Galanenko, M. I. Karnovskiy, and L. G. Krasnyy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 113-121 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 136-145 (For availability see N74-32136 21-23)

The possibility of obtaining unbiased and justifiable estimates using averaging with respect to the scalar or vector argument is guaranteed by the ergodic properties of a random field. The requirement of ergodicity imposes defined restrictions on the shape of the correlation function of the averaged random field. The sufficient condition of ergodicity of a random field is formulated and proved. Author

N74-32147 Joint Publications Research Service, Arlington, Va.
OPTIMAL TIME-SPACE PROCESSING OF SIGNAL IN A GAUSSIAN NOISE FIELD
V. B. Galanenko, N. G. Gatkin, and L. G. Krasnyy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 122-131 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 146-156 (For availability see N74-32136 21-23)

Results are given of investigations conducted of special cases of wideband and narrow band noise and noiseproofness of the optimal receiver. A.L.

N74-32148 Joint Publications Research Service, Arlington, Va.
FAST FOURIER TRANSFORMATION AND THE POSSIBILITIES OF ITS APPLICATION IN STATISTICAL HYDROACOUSTICS
V. A. Geranin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 132-164 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 157-194 (For availability see N74-32136 21-23)

The fast Fourier transformation (FFT) algorithm is an economical method of calculating the finite Fourier transformation (FiFT). The FFT is applicable only in those cases where the content can be discussed in the FiFT language. Therefore, the analysis of the potential possibilities of applying the FFT in scientific and engineering applications is none other than the analysis of the possibilities of the FFT. Here a deep understanding of the structure and specific nature of this version of the Fourier transformation is most important. This is especially true in that this specific nature generates its own problems, the solution of which is admissible only on the basis of methods and means specially developed for it. Some of the characteristic features of the FiFT are described and the possibilities of applying it in problems of statistical hydroacoustics are discussed. Author

N74-32149 Joint Publications Research Service, Arlington, Va.
A METHOD OF PROCESSING HYDROACOUSTIC SIGNALS
G. M. Makhonin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 165-174 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 195-206 (For availability see N74-32136 21-23)

The progress made in recent years in techniques and equipment for measuring the statistical characteristics of random processes provide a basis for hoping for the possibility of practical application of finer than purely energy properties of a signal for its detection. In particular, it is expendient to use for this purpose the difference in the one-dimensional probability distribution functions of the signals and noise. The application of the estimates of these functions is attractive for a number of reasons, the basic ones of which are the theoretical independence of the values of the functions of the central frequency of the signal and its modulation of the type of noise spectrum and also the comparative simplicity of the technical realization of the corresponding signal processing devices. Some versions of solution of the problem of signal detection against a background of noise with respect to differences in their one-dimensional probability densities are presented. Author

N74-32150 Joint Publications Research Service, Arlington, Va.
ADAPTIVE METHODS OF MEASURING THE DYNAMIC COORDINATES OF SIGNAL SOURCES. PART 2: SYNTHESIS OF BASIC ASSEMBLIES OF ADAPTIVE METERS
A. M. Zufrin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 175-193 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 207-229 (For availability see N74-32136 21-23)

When synthesizing adaptive devices for measuring the information parameters of received signals it is necessary to consider that the methods of optimizing the channels for measuring the angular information and the channels for measuring the time information (the information about range) differ significantly. However, in a number of cases the requirements on the time parameters of the main bang in the rangefinding channels coincide with the requirements on the shape of the radiation pattern in the goniometric channels; therefore, the optimization techniques based on insuring the given shape of the radiation pattern can be used to insure the given form of the envelope of the signal and vice-versa. Author

N74-32151 Joint Publications Research Service, Arlington, Va.
A METHOD OF ESTIMATING THE NOISEPROOFNESS OF THE WIDE-BAND SIGNAL DETECTOR UNDER THE CONDITIONS OF A NONSTATIONARY INTERFERENCE FIELD
V. B. Idin and V. A. Kakalov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 194-199 Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 230-237 (For availability see N74-32136 21-23)

A procedure is proposed for estimating the noiseproofness of the wideband signal detector under the conditions of nonstationary noise based on a comparison with an analogous system in a stationary field with respect to the output effect of the post-detector filter in the absence of a signal. For the detector, the parameters of which were calculated from the operating conditions in the stationary noise field, the result of the comparison is represented in the form of a loss of noiseproofness estimated as equivalent, from the point of view of an increase in noise power at the output of the post detector filter, expansion of the band of this filter for operation of the detector in the hypothetical stationary field. A comparison is made on the basis of the experimental data for the analysis of which a study is made of the nonstationarity of the output effect of the post-detector filter in the part of the spectrum which falls in the filter band matched with the spectrum of the signal envelope. Author

N74-32152 Joint Publications Research Service, Arlington, Va.
PROBLEMS OF PLANNING EXPERIMENTAL STUDIES AND STATISTICAL MEASUREMENTS
V. V. Olshevskiy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 200-214 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 238-255 (For availability see N74-32136 21-23)

The studies of the properties of various phenomena or objects in hydroacoustics, as a rule, reduces to the study of the properties of the corresponding functions characterizing their behavior in time and space. If the objects are of sufficiently complex nature, then their behavior in all standard situations and situations of interest in practice cannot be described by the functions of the known type, that is, the problem of their description is not deterministic. The corresponding solutions of the equations of mathematical physics either gives highly simplified representations of the properties of the investigated objects or these solutions are approximate in view of the incompleteness of the initial data and complexity of the equations. This leads to the necessity for considering the mentioned functions as random processes and the study of their probability and statistical properties. For experimental research the following four goals for the solution of which the research is performed are discussed: (1) accumulation of information about the properties of the investigated object; (2) checking the correctness of the developed theory; (3) statement and solution of the inverse problem, and (4) search for new properties of the investigated objects. Author

N74-32153 Joint Publications Research Service, Arlington, Va.
PROBLEMS OF ESTIMATING THE EFFECTIVENESS OF SCIENTIFIC-TECHNICAL PROPOSALS
G. Ya. Goldshteyn and V. V. Olshevskiy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 215-221 ref Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 256-262 (For availability see N74-32136 21-23)

Estimating the effectiveness of various scientific and technical proposals aimed at improving the existing methods and technical systems is acquiring great significance. This situation is determined by a number of basic factors: (1) The modern state of the art in the development of engineering, the statement of experimental research, and so on are such that checking the scientific and technical proposals and their introduction are connected, as a rule, with significant material expenditures. (2) Within the framework of any branch the resources planned for scientific and technical supply are limited and naturally must be distributed in the best way from the point of view of the greatest national economic effect. (3) The adoption of certain scientific and technical proposals must promote general progress in the branch. The basic factors affecting the decision making regarding the introduction of proposals are discussed. Author

N74-32154 Joint Publications Research Service, Arlington, Va.
CLASSIFICATION OF RANDOM PROCESSES AND THEIR TRANSFORMATION OPERATORS
V. Ya. Rozenberg *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 222-236 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 263-280 (For availability see N74-32136 21-23)

It has been established that the informativeness of any physical experiment is determined both by the state of the theory (the degree of adequateness of the mathematical model used to the investigated object) and the measurement procedure. Before beginning the experiment it is necessary to have a sufficiently broad assortment of mathematical models ordered in accordance with some classification; in the process of performing the measurement, the investigated object is compared with each of the models, and the numerical values of the parameters determined using the selected model and assigned to the object are discovered. The operativeness of selecting the appropriate model depends on the search algorithm and the method of organizing the thesaurus. Problems of classifying models without touching on the methods of using them to describe real objects are described. Author

N74-32155 Joint Publications Research Service, Arlington, Va.
GAIN OF A RECEIVING ARRAY IN A MULTICOMPONENT INTERFERENCE FIELD
O. M. Aleshchenko and I. P. Yudenkov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 237-239 Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 281-283 (For availability see N74-32136 21-23)

Mathematical expressions are presented that can be useful for engineering calculations connected with estimating the gain of antennas operating in multifrequency and nonisotropic fields. Author

N74-32156 Joint Publications Research Service, Arlington, Va.
APPLICATION OF THE CONSOLIDATION METHOD FOR PROCESSING SIGNALS UNDER THE CONDITIONS OF SIGNIFICANT A PRIORI INDETERMINANCY
V. P. Ryzhov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 240-243 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustiki" Moscow Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 284-288 (For availability see N74-32136 21-23)

In hydroacoustics the use of the indicated models of the signals and interference is far from always possible, therefore, the development of methods of processing the signals under the conditions of significant a priori indeterminancy is of urgency in the solution of the problems of statistical hydroacoustics. The methods of overcoming this a priori difficulty based on the application of nonparametric statistics, adaptive devices and the use of systems redundancy (in particular, multichannel devices) are being developed intensively. It is necessary to note that the realization of the indicated methods is connected with significant

technical difficulties; therefore, the corresponding devices have still not become widespread in practice. A quite constructive principle of the development of signal processing algorithms under the conditions of incomplete a priori information and the devices to implement these algorithms with given systems engineering restrictions is the principle of signal consolidation. Some special aspects of this principle as applied to Marcov processes are discussed. Author

N74-32157 Joint Publications Research Service, Arlington, Va.
STATISTICALLY OPTIMAL DISCRETE ADAPTIVE SYSTEM
V. A. Kurzenev et al *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 244-246 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 288-291 (For availability see N74-32136 21-23)

The solution of the problem of synthesizing the optimal weight function of a discrete measuring system with respect to the minimum total error leads to the weight function which depends on the current characteristics of the signal and the statistical characteristics of the interference. These characteristics cannot be a priori given sufficiently accurately. For more exact consideration of the real situation it is expedient to approximately estimate the parameters characterizing the signal and interference by the system and then consider them in the procedure of subsequent measurements which leads to the adaptive system. Here the conditions of convergence of the iteration measurement procedure is of interest. Results are presented from studying these problems for a system which is optimal from the point of view of known total error where the random interference and regular signal arriving at the system input satisfy the established conditions. Author

N74-32158 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF THE OPTIMAL RECEIVERS OF POLYHARMONIC SIGNALS WITH NONRAYLEIGH DISTRIBUTION OF THE HARMONIC AMPLITUDES
O. A. Rogozovskiy *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 247-250 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 292-296 (For availability see N74-32136 21-23)

The application of the fast Fourier transform algorithm in the form of a program for all-purpose digital computers or in the form of a specialized processor permits calculation of 1000 or more Fourier coefficients in a time scale close to real which offers the possibility of using this algorithm for practical construction of receivers of signals with unknown frequency of the first harmonic and nonRayleigh distribution of the harmonic amplitudes. Author

N74-32159 Joint Publications Research Service, Arlington, Va
FREQUENCY OPTIMIZATION OF MEASURING HYDROACOUSTIC EQUIPMENT AND METHOD OF ESTIMATING THE VARIATION OF ITS RANGE
V. I. Mazepov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 251-255 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTR, 9 Aug. 1972 p 296-301 (For availability see N74-32136 21-23)

One of the means of increasing the efficiency of the hydroacoustic measuring equipment is frequency optimization of its parameters considering the set of frequency functions of spectral signal and noise characteristics, the acoustic characteristics of the ocean, and the frequency effect of the information processing system. The problems of frequency optimization of hydroacoustic equipment have been investigated with respect to more specific definition of the basic relations for frequency optimization and development of the method of estimating the variation in range of the frequency-optimized measuring hydroacoustic equipment. Author

N74-32160 Joint Publications Research Service, Arlington, Va.
ECHO RECEPTION NOISEPROOFNESS OF A RECEIVER OPTIMAL FOR THE MAIN BANG
V. M. Pyanov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 256-262 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 302-309 (For availability see N74-32136 21-23)

The creation of mathematical models and investigation of the deformation of echoes have been the topic of comprehensive papers. A study was made of the noiseproofness of the receiver which is optimal for the main bang on reception of the echo. Author

N74-32161 Joint Publications Research Service, Arlington, Va.
ROLE OF MEMORY IN MULTIFRAME SIGNAL DETECTION
L. S. Kabakov *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 263-266 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 310-314 (For availability see N74-32136 21-23)

In estimating the role of the memory of the display units in the problem of multiframe signal detection, results indicate first the stability of the characteristics of the path with respect to the effect of the pulse noise and secondly that considering the experimental conditions the human observer has the characteristics between the characteristics of incoherent storage and the characteristics of the 1 out N criterion. The latter emphasizes the idea of the secondary processing filter of the first type in the form of the adaptive video filter. Its parameters are such that it is always matched with the pulse, the duration of which is equivalent to the path length. The noise has a correlation time N times less than the duration of the useful signal. This system is invariant not only with respect to the effect of asynchronous noise but also the shape of the path, including the case of branched and intercepting paths. Author

N74-32162 Joint Publications Research Service, Arlington, Va.
A METHOD OF MULTIPLICATION OF REALIZATIONS OF THE HYDROACOUSTIC SIGNALS
G. Ya. Voloshin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 267-272 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statistiches-koy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 314-321 (For availability see N74-32136 21-23)

In recent years the methods of automatic pattern recognition have become widespread in hydroacoustics. One of the prospective methods of doing research in the development of automated complexes of fish finding equipment is simulation on a computer. When simulating the recognition system it is necessary to provide for processing a sufficient quantity of realizations of the signals. For this purpose it is possible to use either the input of recordings of real signals to the computer or programmed synthesis of these signals. The selection of one path or another is determined by the specific conditions of performing the research. In particular, many algorithms for the recognition and search for informative attributes have a clearly expressed capacity of adapting to the realizations of the signals which go to the system input. In such cases it is desirable to have the possibility of generating as large a sequence of signals as possible. The synthesized sequence must have the same statistical properties as the set of existing real signals. In this sense, multiplication of the realizations of random signals were also considered. Author

N74-32163 Joint Publications Research Service, Arlington, Va.
A STATISTICAL METHOD OF ESTIMATING NONLINEAR DISTORTIONS IN HYDROACOUSTIC SYSTEMS AND COMMUNICATIONS CHANNELS
S. G. Gershman, V. P. Prikhodko, and V. D. Svet *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 273-278 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 322-327 (For availability see N74-32136 21-23)

For statistical processing of hydroacoustic signals there is a necessity for estimating their nonlinear distortions arising both

in the systems themselves and in the communications channels. The known correlation methods of estimating the nonlinear distortions in the communications channels, the river channels, the acoustic systems, and so on, as a rule, are based on measuring the mutual correlation coefficient either between the input and output of equivalent nonlinear quadripole or between the low frequency signal and the envelope of the high frequency combination section of the spectrum at the output of the quadripole. These methods are characterized by defined deficiency: the dependence of the estimate of the nonlinear distortions on the additive noise which always occurs in the indicated system which does not offer the possibility of considering the effect of the nonlinearity and the noise on the mutual correlation function separately. Therefore, it is desirable to have the estimate of the nonlinear distortion which will not depend on the effect of the additive noise. Author

N74-32164 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF A SOUND FIELD OCCURRING IN WATER AS A RESULT OF THE FRACTURE FORMATION IN THE ICE COVER
S. A. Voytsekhovskaya *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 279-285 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 328-334 (For availability see N74-32136 21-23)

When studying the noise under the ice, the problem of the sound field arising in the liquid as a result of the formation of fractures of the ice cover under the effect of its bending oscillations is of definite interest. Formulas are given which offer the possibility, in the case of knowing the energy spectrum of the bending oscillations of the ice cover causing its fractures and also the distributions of these fractures with respect to the surface of the ice cover and in time, of calculating the correlation functions (space and time) and the dispersion of the acoustic field of the fractures in the liquid. Author

N74-32165 Joint Publications Research Service, Arlington, Va.
USE OF THE DISPERSION OF MEDIA FOR SPACE-TIME FOCUSING OF WAVE GROUPS
V. G. Sapogin and L. G. Sapogin *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 285-287 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 334-337 (For availability see N74-32136 21-23)

In the modern methods of location, reception and translation of information, wide band signals are used with a base value which as a result of their correlation properties can be convoluted into a narrow pulse after optimal processing in the receiving channel. As a result of a known complication of the signal processing system this permits an increase in the signal/noise ratio at the output of the receiver. One of the distorting factors which the known communication channels have is dispersion. It changes the phase spectrum of the signal during its propagation. It is shown that the linear, stationary nonabsorbing dispersion communication channel can be used for space-time focusing of the wave groups. Author

N74-32166 Joint Publications Research Service, Arlington, Va.
MODELS OF NEAR BOTTOM SHAPED HYDROACOUSTIC SIGNALS
T. V. Polyanskaya and M. I. Skipa *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 288-292 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 337-343 (For availability see N74-32136 21-23)

The study of the process of propagation and shaping of a hydroacoustic signal in the near bottom space is necessary for the solution of various types of physical problems occurring in oceanology, seismology, marine geology. In order to determine the peculiarities and laws of formation of the signal near the bottom it is necessary to study its statistical characteristic which can most efficiently be done by constructing mathematical models of the signal and their subsequent analysis. At the present time when creating the mathematical models of hydroacoustic signals two basic approaches are adopted; wave and phenomenological including canonical and structural models. When constructing and analyzing the models the basic principles are the following: consideration of the initial information about the properties of the medium, its inhomogeneities, boundaries and sources; obtaining statistical information on the basis of analyzing the initial data. Author

N74-32167 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF EXPERIMENTAL STUDIES OF MARINE REVERBERATION DURING THE EMISSION OF COMPLEX SIGNALS
I. V. Yemelyanenko, Ye. B. Libenson, A. F. Paliy, and A. I. Paperno *In its* Topics of Rept. of the 3d All-Union Seminar on Statist. Hydroacoustics (JPRS-62571) 25 Jul. 1974 p 293-296 refs Transl. into ENGLISH from the book "Tezisy Dokladov Tretyey Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Moscow, Izd. Sektor VNIIFTRI, 9 Aug. 1972 p 343-347 (For availability see N74-32136 21-23)

Results are presented from an experimental study of the degree of correlation of the marine reverberation and complex main bangs during mutual correlation processing. Author

N74-32168# National Bureau of Standards, Boulder, Colo. Electromagnetic Metrology Information Center.
THE MEASUREMENT OF NOISE PERFORMANCE FACTORS: A METROLOGY GUIDE Final Report
M. G. Arthur, ed. and W. J. Anson Jun. 1974 202 p refs (NBS Proj. 2729103)
(NBS-Mono-142; LC-74-7439) Avail: SOD HC $5.45 as C13.44:142

This metrology guide provides the basis for critical comparisons among seven measurement techniques for average noise factor and effective input noise temperature. The techniques that are described, discussed, and analyzed include the (1) Y-Factor, (2) 3-db, (3) automatic, (4) gain control, (5) CW, (6) tangential, and (7) comparison techniques. The analyses yield working equations and error equations by which accuracy capabilities are compared. Each technique is also analyzed for (1) frequency range for best measurement results, (2) special instrumentation requirements, (3) speed and convenience, (4) operator skill required, and (5) special measurement problems. General instrumentation requirements and practical measurement problems are discussed. Examples illustrate the principles involved in applying the working and error equations. An extensive bibliography and suggested reading list aid the metrologist to locate additional material on these measurements. Author

N74-32169*# Linguistic Systems, Inc., Cambridge, Mass.
CURVES OF EQUAL LOUDNESS FOR OCTAVE BANDS
G. Jahn Washington NASA Aug. 1974 12 p refs Transl. into ENGLISH from Hochfrequenztech. Elektroakust. (East Germany), v. 67, no. 6, 1959 p 187-189
(Contract NASw-2482)
(NASA-TT-F-15742) Avail: NTIS HC $4.00 CSCL 20A

Stimulated by the generally accepted method of Stevens, measurements of the isophons for octave-bands were undertaken. At first these were limited to diffuse acoustic field with comparison of octave-bands in the middle frequencies; later, through tests on 10 persons, the curves of equal loudness for octave bands of 40 phons in the frontal oncoming plane wave and diffuse acoustic field were determined. Attention is given, to the loudness of the sound level for a chosen comparison signal, so that measured curves can be truly identified with a loudness in phons. Author

N74-32170# Technology Service Corp., Silver Spring, Md.
STUDIES OF MONOCHROMATIC, QUASI-MONOCHROMATIC AND BROADBAND IMAGING TECHNIQUES Interim Technical Report
F. L. Rees, L. B. Palmer, and L. W. Brooks 18 Mar. 1974 78 p
(Contract N00014-73-C-0267)
(AD-780443) Avail: NTIS CSCL 17/1

Passive imaging techniques are considered for the entire range of acoustic signal classes. Methods are developed for imaging of monochromatic point-sources, linear distributions of quasi-monochromatic sources (deterministic carrier-frequency with

slow and random fluctuations of amplitude and phase), and broadband sources. Imaging of a monochromatic point-source is performed by focusing a synthetic aperture on the radiator. However, this technique is not applicable for wider classes of signals. Thus a power cross-covariance measure of field points is used to image quasi-monochromatic sources. To image broadband sources, it is to show that real apertures must be considered. A subsequent report will provide a unifying theory of passive imaging in the form of a generalized imaging integral. Author (GRA)

N74-32171# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FREQUENCY SPECTRUM OF OPTICAL WAVES PROPAGATION IN A MOVING TURBULENT ATMOSPHERE Physical Sciences Research Papers
Ronald L. Fante 8 Mar. 1974 23 p refs
(AF Proj. 5635)
(AD-780623; AFCRL-TR-74-0135; AFCRL-PSRP-591) Avail: NTIS CSCL 20/6

The authors have calculated the frequency spectrum of plane waves and beams propagating in a moving turbulent atmosphere. Both the case when the atmosphere moves with a constant wind and the case when the wind velocity is distributed according to a gaussian centered about some average velocity is considered. The results indicate that for small propagation distances, the frequency spectrum behaves as omega sup -8/3 for large frequency, omega; for large propagation distances, the spectrum is broadened with increasing distance-with the broadening dependent upon the beam parameters and the wind velocity. Author (GRA)

N74-32172# Naval Research Lab., Washington, D.C.
ARPA-NRL INFRARED INTEGRATED OPTICS PROGRAM Annual Technical Report, 1 Dec. 1972 - 31 Jan. 1974
T. G. Giallorenzi and John Warner Apr. 1974 42 p refs
(ARPA Order 2327)
(AD-780780; NRL-MR-2783) Avail: NTIS CSCL 20/6

The ARPA-NRL integrated optics program is concerned with the development of an infrared integrated optical technology. The report discusses the NRL in-house program on thin film magneto-optical isolators. Both theoretical and experimental aspects have been studied in detail. Author (GRA)

N74-32173# Sperry Rand Research Center, Sudbury, Mass.
TIME DOMAIN MEASUREMENT OF MICROWAVE ABSORBERS 9-16 GHz FREQUENCY BAND Final Report, 15 Apr. - 31 Oct. 1973
A. M. Nicolson, Harry M. Cronson, Peter G. Mitchell, and Richard M. Mara Apr. 1974 42 p
(Contract F33615-73-C-1278; AF Proj. 7633)
(AD-779815; SCRC-CR-73-10; AFAL-TR-73-435) Avail: NTIS CSCL 17/4

The report describes a time domain metrology system built to extend the measurement capability of the properties of radar absorbing materials used on aircraft and missiles. A system is presently operating in the Air Force Avionics Laboratory, WPAFB, which measures the transient response of subnanosecond risetime pulses and calculates the dielectric constant epsilon* and the magnetic permeability mu* over the frequency range 0.1-10 GHz. The system to be described will extend this capability through the frequency range 9-16 GHz. Author (GRA)

N74-32174# Temple Univ., Philadelphia, Pa. Dept. of Physics.
RENORMALIZATION GROUP IN CRITICAL PHENOMENA AND QUANTUM FIELD THEORY Final Report, Apr. - Oct. 1973
J. D. Gunton and M. S. Green 1974 207 p refs Conf. held Chestnut Hill, Pa., 29-31 May 1973
(Grants AF-AFOSR-2530-73; Nonr(G)-00012-73)
(AD-781078; AFOSR-74-0990TR) Avail: NTIS CSCL 20/10

Because the origin of the renormalization group is in quantum field theory and more importantly because applications of the theory in phase transitions have reflected back into quantum field theory it was decided that the conference should cover the renormalization group in critical phenomena and quantum field theory. The conference took place at the Temple University Conference Center at Sugarloaf, Chestnut Hill, Pa. on May 29, 30 and 31, 1973. The present publication is the Proceedings of the Conference. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-32175*# Virginia Univ., Charlottesville. Dept. of Chemistry.
QUANTITATIVE MULTIELEMENT ANALYSIS USING HIGH ENERGY PARTICLE BOMBARDMENT
Patrick J. Clark, George F. Neal, and Ralph O. Allen [1974] 40 p refs
(Grant NGR-47-005-176)
(NASA-CR-139619) Avail: NTIS HC $5.00 CSCL 20H

Charged particles ranging in energy from 0.8 to 4.0 MeV are used to induce resonant nuclear reactions, Coulomb excitation (gamma X-rays), and X-ray emission in both thick and thin targets. Quantitative analysis is possible for elements from Li to Pb in complex environmental samples, although the matrix can severely reduce the sensitivity. It is necessary to use a comparator technique for the gamma-rays, while for X-rays an internal standard can be used. A USGS standard rock is analyzed for a total of 28 elements. Water samples can be analyzed either by nebulizing the sample doped with Cs or Y onto a thin formvar film or by extracting the sample (with or without an internal standard) onto ion exchange resin which is pressed into a pellet. Author

N74-32176# Notre Dame Univ., Ind. Dept. of Physics.
NUCLEAR STRUCTURE RESEARCH Annual Report, 1 Jan. - 31 Dec. 1973
Jun. 1974 198 p refs
(Grants NSF GP-27456; PS-207320G)
Avail: NTIS HC $13.00

Some of the highlights in research work include: (1) analysis of excitation energy differences among Co-55 levels; (2) measurements on vector polarized deuteron reactions in light nuclei; (3) spins, lifetimes, and cross section measurements on Mn-55; and (4) positions and spins in Er and Gd nuclei levels. G.G.

N74-32177*# New Hampshire Univ., Durham. Dept. of Physics.
POLARIZATION OF THE LIGHT FROM THE 3P(1)-2S(1) TRANSITION IN PROTON BEAM EXCITED HELIUM Ph.D. Thesis
Martin S. Weinhous Dec. 1973 206 p refs
(Contract NAS5-11054; Grants NGL-30-002-018; NGL-30-002-021; NGR-30-002-104)
(NASA-CR-139639) Avail: NTIS HC $13.50 CSCL 20H

Measurements of the polarization of the light from the 3 1p-2 1s transition in proton beam excited Helium have shown both a proton beam energy and Helium target gas pressure dependence. Results for the linear polarization fraction range from +2.6% at 100 keV proton energy to -5.5% at 450 keV. The zero crossover occurs at approximately 225 keV. This is in good agreement with other experimental work in the field, but in poor agreement with theoretical predictions. Measurements at He target gas pressures as low as .01 mtorr show that the linear polarization fraction is still pressure dependent at .01 mtorr. Author

N74-32178*# Scientific Translation Service, Santa Barbara, Calif.
MULTIPLE PARTICLE PRODUCTION
G. B. Zhdanov Washington NASA Aug. 1974 200 p refs Transl. into ENGLISH of the book "Mnozhestvennaya Generatsiya Chastits" Moscow, Nauka Press, 1974 p 1-168
(Contract NASw-2483)
(NASA-TT-F-15757) Avail: NTIS HC $13.00 CSCL 20H

Experimental methods of studying multiple particle generation

with the aid of cosmic rays and powerful charged particle accelerators are reported. Author

N74-32179*# Columbia Univ., New York. Astrophysics Lab.
RESEARCH ON THE PROPERTIES AND INTERACTIONS OF SIMPLE ATOMIC AND IONIC SYSTEMS Final Report, 1 Jan. 1963 - 31 Dec. 1972
R. Novick 31 Dec. 1972 22 p refs
(Grant NGL-33-008-009)
(NASA-CR-139666; CAL-1263) Avail: NTIS HC $4.25 CSCL 20H

Simple ionic systems were studied, such as metastable autoionizing states of the negative He ion, two-photon decay spectrum of metastable He ion, optical excitation with low energy ions, and lifetime measurements of singly ionized Li and metastable He ion. Simple atomic systems were also investigated. Metastable autoionizing atomic energy levels in alkali elements were included, along with lifetime measurements of Cr-53, group 2A isotopes, and alkali metal atoms using level crossing and optical double resonance spectroscopy. J.A.M.

N74-32180# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE AMOUNT OF MATTER IN A MATTER-ANTIMATTER MODEL OF THE UNIVERSE
J. J. Aly, S. Caser, R. Omnes, J. L. Puget, and G. Vallades Mar. 1974 33 p refs
(LPTHE-74/12) Avail: NTIS HC $4.75

The amount of matter in a matter-antimatter symmetric universe is calculated assuming some symmetry breaking due to a phase separation of matter from antimatter at high temperatures. Attention is given to the importance of initial correlations and the determinant role of neutron diffusion in annihilation. These two effects, and several others, are included and further analyzed. It turns out that the final amount of matter that is found is lower than observed in a perfectly quiet universe. However, it is also found that any small amount of initial turbulence is enough to break the initial correlations to give exactly the observed amount of matter. Author

N74-31821 National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
MODIFIED ELECTRON DISTRIBUTION FUNCTION DURING PARAMETRIC INSTABILITIES
Jerome Weinstock and Bandel Bezzerides *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 6 p refs (For availability see N74-31812 21-13)

N74-31839 New England Univ., Armidale (Australia).
ELECTRON HEATING IN THE IONOSPHERE BY POWERFUL GYRO-WAVES
R. A. Smith and R. G. Loch (Warrnambool Inst. of Advanced Education, Victoria, Australia) *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 14 p refs (For availability see N74-31812 21-13)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-32181 Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE "ROCHE-LIMIT" OF IONOSPHERIC PLASMA AND THE FORMATION OF THE PLASMAPAUSE
J. Lemaire 1973 26 p refs Presented at the Belgo-Brit. Univ. Week (Europalia 1973), 24 Oct. 1973 Submitted for publication
(Aeronomica-Acta-A-122-1973) Avail: Issuing Activity

The plasmapause position is determined by the innermost equipotential surface which is tangent to the Roche-limit surface of the ionospheric plasma filling the magnetosphere. When the thermal particles corotate with the earth's angular velocity, the Roche-limit equatorial distance is Lc = 5.78 (RE). When the angular velocity is evaluated from the quiet time convection electric field distribution E3 Lc depends on the local time. Its minimum value is then Lc = 4.5 near 2400 LT, and the plasmapause position and shape satisfactorily fit the observations. The diffusive equilibrium density distribution appropriated inside the plasmasphere becomes convectively unstable beyond L = Lc where the collisionless type of model represents satisfactorily the observations. In the intermediate region between the plasmapause and the last closed magnetic field line, a continuous ionization flux is expected to flow out of the midlatitude ionosphere as in the polar wind. Author (ESRO)

N74-32182# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
EXPERIMENTAL AND COMPUTATIONAL STUDY OF THE LOW DENSITY PLASMA IN THE OUTER REGIONS OF A THETA PINCH
P. Hafner and F. Hofmann Jul. 1974 23 p refs
(LRP-85/74) Avail: NTIS HC $4.25

The time evolution of the electron density was measured in the outer regions of a fast theta pinch by means of a Mach-Zehnder interferometer. The results show that the electron density outside the central plasma column is relatively high. A comparison of these measurements with theoretical calculations leads to the conclusion that the pinch must be unstable during the implosion phase. Author

N74-32183# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF A STATIONARY PLASMA ENGINE AND ITS TESTING ABOARD THE METEOR ARTIFICIAL EARTH SATELLITE
L. A. Artsimovich, I. M. Andronov, Yu. V. Yesipchuk, I. A. Barsukov, K. N. Kozubskiy, Yu. M. Levchenko, V. A. Mikhaylichenko, A. I. Morozov, Ye. M. Petrov, and M. K. Romanovskiy 27 Aug. 1974 31 p refs Transl. into ENGLISH from Kosm. Issled. (Moscow), no. 3, 1974 p 451-468
(JPRS-62823) Avail: NTIS HC $4.75

Data on the development and testing aboard the 'Meteor' artificial earth satellite of an experimental correcting engine complex with stationary plasma engines. Author

N74-32184*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
A THEORETICAL MODEL OF THE WAVE PARTICLE INTERACTION OF PLASMA IN SPACE Final Technical Report
S. T. Wu and R. J. Hung Jun. 1974 52 p refs
(Contract NAS8-29501)
(NASA-CR-120411; UAH-RR-155) Avail: NTIS HC $5.75 CSCL 20I

A theoretical model, based on the kinetic theory for the perturbation of plasma in the magnetosphere, is proposed to study the observed disturbances which are caused by both natural and artificial sources that generate wave-like perturbations propagating around the globe. The proposed model covers the wave propagation through a media of transitional (from collisional to collisionless) fully ionized magnetoactive plasma. A systematic formulation of the problem is presented and the method of solution for the transitional model of magnetosphere is discussed. The possible emission of hydromagnetic waves in the magnetosphere during the quiet and disturbed time are also discussed. Author

N74-32185*# Kanner (Leo) Associates, Redwood City, Calif.
GENERATION AND HEATING OF PLASMAS THROUGH ABSORPTION OF INTENSIVE LASER BEAMS
W. Boegershausen and R. Vesper Washington NASA Sep. 1974 23 p refs Transl. into ENGLISH from Spectrochim. Acta (England), v. 24B, 1969 p 103-116 (German language document)
(Contract NASw-2481)
(NASA-TT-F-15894) Avail: NTIS HC $4.25 CSCL 20I

The conditions for producing laser plasmas for spectrochemical analysis are discussed using a simplified model. This model is compared with experimental observations on plasmas generated by focused radiation of lasers operated in the normal non-Q-switched as well as in the Q-switched mode. Several materials were investigated (C, Al, Fe, Zn, W, and Pb) and measurements of the total amount of material being produced by the laser beam, of the kinetic energies of the plasma particles expanding

in vacuum, and of the excitation temperature were made. In addition, time-resolved observations were made. Plasmas produced by normal mode laser pulses exhibited excitation temperatures of 4900 K (C) up to 7900 K (W), while those produced by a series of giant pulses had temperatures up to 12,000 K (Fe). In the latter case, average particle energies of about 3.5 eV were measured under the same conditions.

Author

N74-32186# Commissariat a l'Energie Atomique, Grenoble (France). Dept. de la Physique du Plasma et de la Fusion Controlee.

FILLING-UP OF CLOSED MAGNETIC CONFIGURATIONS USING A LASER CREATED PLASMA

G. Tonon 1973 17 p refs In FRENCH; ENGLISH summary Presented at the Congr. on the Centenary of the French Phys. Soc., Vittel, France, 28 May - 2 Jun. 1973

(CEA-Conf-2474; Conf-730574-13) Avail: AEC Depository Libraries HC $3.00

The interaction of a laser beam with a pellet of solid deuterium injected directly into the center of a magnetic configuration was studied. The characteristics of the laser pulse were chosen in such a way as to completely ionize the pellet. The expansion of the plasma in a closed magnetic configuration was studied.

Author (NSA)

N74-32187# Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges (France).

STOCHASTIC KINETIC THEORY OF THE INTERACTION OF AN ELECTRON PLASMA WITH AN ELECTROMAGNETIC WAVE Ph.D. Thesis - Paris Univ., France

G. diBona Mar. 1974 101 p refs In FRENCH

(CEA-R-4537) Avail: AEC Depository Libraries HC $7.25

The interaction of an electron plasma with a high frequency electromagnetic field is studied using the Stratonovitch stochastic method. A hierarchy of equations is obtained. A small dimensionless expansion parameter is used to break this hierarchy. A set of two equations governing the system is obtained. The solution of this set of equations leads to the computation of the friction and diffusion terms of the equation describing the behavior of the one particle distribution function. Three kinetic equations are obtained depending on the value of the expansion parameter, i.e., two for the weak electromagnetic field and one for the strong electromagnetic field. Author (NSA)

N74-32188# Paris Univ., Orsay (France).

THEORETICAL AND EXPERIMENTAL STUDY OF CRYOGENIC He PLASMAS Ph.D. Thesis

C. Vauge 1972 196 p refs In FRENCH

(FRNC-TH-429) Avail: AEC Depository Libraries HC $11.50

A bibliography of numerical data available on plasmas is presented. The effect of a drop in temperature on the behavior of the afterglow, and in particular, the occurrence of large quantities of new ion species such as the triatomic ion, He-3+ was studied. Calculations were effected on the structure, ground state vibration frequencies, and dissociation energy using molecular physics methods. The interaction energy of this system was obtained by applying the same methods of calculation to the system formed between a He-3+ ion and a helium atom. It was shown that some transport coefficients associated with this potential, such as the mobility, can be described by an effective spherical potential simply deduced from the interaction energy. The resulting mobility is in reasonably good agreement with the experimental measurements. A complex experimental device was developed enabling afterglows in very pure helium to be produced and investigated at temperatures of between 300 K and 4.2 K.

Author (NSA)

N74-32189# Sandia Labs., Albuquerque, N.Mex.

RADAR BACKSCATTERING BY A RANDOM PLASMA SLAB

W. D. Brown Mar. 1974 39 p refs

(Contract AT(29-1)-789)

(SLA-73-1072) Avail: NTIS HC $4.00

The scattering of a radar wave which is normally incident on a turbulent plasma slab whose properties vary only in the direction of incidence is examined. A formulation which separates the contributions of the fluctuating properties of the plasma to the scattering from the contributions of the ensemble averaged properties is developed. The formulation is then specialized so that the contributions of the ensemble averaged properties are taken into account in an eikonal approximation and the contributions of the fluctuating properties are described by a multiple scattering expansion in which an eikonal Green's function describes the propagation of the electromagnetic wave between scatterings. Expressions are derived for the eikonal electric field functions, the eikonal Green's functions, and the ensemble averaged scattering cross section in the Born-eikonal formulation. A random plasma slab model is introduced for the purpose of comparing numerically the Born Approximation, the Born-eikonal formulation, and the exact results. Author (NSA)

N74-32190# United Aircraft Corp., East Hartford, Conn. Research Labs.

HIGH-BETA CAPTURE AND MIRROR CONFINEMENT OF LASER-PRODUCED PLASMAS Semiannual Report, 1 Aug. 1973 - 31 Jan. 1974

A. F. Haught, D. H. Polk, J. T Woo, W. J. Fader, R. G. Tomlinson, R. A. Jong, and W. B. Ard 31 Jan. 1974 49 p refs

(Contract AT(11-1)-2277)

(COO-2277-3; UARL-N-921514-20) Avail: NTIS HC $5.50

Experimental studies aimed at improving the reproducibility of the dense, laser produced plasmas were performed. Efforts in this area were concerned with the positioning of the target particle more accurately in the laser focal region and with preventing the premature displacement of the particle from the focal region. To address this latter problem, the single beam laser system of the previous experiments was modified to permit the simultaneous irradiation of the lithium hydride pellet by two opposed laser beams. In addition, the diagnostic capabilities of the present experiment were augmented so that more detailed measurements of the plasma lifetime, density, and energy can be made. A 4 mm microwave interferometer was installed to follow the plasma decay from higher densities. The measured density decay histories were analyzed to give estimates of the plasma lifetime and energy. Independent measures of the time dependence of the plasma radius were obtained from both microwave interferometry and optical streak photography. Author (NSA)

N74-32191# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

NONLINEAR FREQUENCY- AND WAVE NUMBER SHIFT OF ELECTROSTATIC WAVETRAINS

Hans Schamel 1973 43 p refs

(MPI-PAE-Astro-57) Avail: NTIS HC $5.25

A class of stationary electrostatic waves with small but finite amplitude is constructed which, is one physical subclass of the class of all BGK solutions. The solutions belonging to it are distinguished by well-behaved distribution functions and reduce to linear solutions for vanishing amplitude. The wave is necessarily non-monochromatic and due to the distortions the wavenumber as well as the frequency deviate from their linear values. In general the nonlinear dispersion relation depends on the waveform which in turn depends on the strength of nonlinearity but is independent of the type of wave. The modulational instability for small distorted periodic wavetrains is investigated.

Author (ESRO)

N74-32192# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany).

A NEW METHOD OF VELOCITY MEASUREMENT FOR FLOWING PLASMAS BY MEANS OF DOPPLER SHIFT [EIN NEUES VERFAHREN DER GESCHWINDIGKEITSMESSUNG VON STROEMENDEN PLASMEN MITTELS DOPPLERVERSCHIEBUNG]

Siegfried Kelm 1974 21 p refs In GERMAN; ENGLISH summary

(DLR-Mitt-74-04) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 9,60 DM

A method of velocity measurement for a flowing plasma is proposed for a range of 1000 to 2000 m/s. The Doppler shift of spectral lines can be measured by position diodes of semiconducting material. Light input signal for the diode must lie over the noise level, therefore, an image intensifier tube must be used for the light amplification of the spectral line. Calculation of the absolute light intensity for the plasma flow shows that

the use of an image intensifier is necessary. The method described here for measuring velocities has a better accuracy than the other methods by which the very small Doppler shift on photographic plates is measured directly. Author (ESRO)

N74-32193# Princeton Univ., N.J. Plasma Physics Lab.
PLASMA MODIFICATION ASSOCIATED WITH PARAMETRIC INSTABILITIES DRIVEN BY INTENSE ELECTROMAGNETIC WAVES
James T. Flick and Hans W. Hendel Apr. 1974 39 p refs
(Contract F30602-73-C-0163; ARPA Order 1423; AF Proj. 1423)
(AD-780033; RADC-TR-74-126) Avail: NTIS CSCL 20/9

The purpose of the experimental effort is to study, in laboratory plasma, effects relating to observations of enhanced absorption of electromagnetic waves in the ionosphere. The experiments were performed in a Q-machine plasma, which has comparable ion and electron temperatures, similar to the ionosphere. The isothermal (T sub e about = (T sub i) parametric ion acoustic decay instability, expected to cause modification of the ionosphere upon irradiation by intense electromagnetic waves (omega sub 0) < or = (omega sub pe), has been studied in detail in laboratory Q-machine plasmas. The instability is conclusively identified by wavelength and frequency measurements, over all parameters determined ranges (k (lambda sub de) < or = 0.2; (omega sub LF)/(omega sub pi) < or = 1). Other parameters determined are instability threshold and maximum acoustic frequency dependence upon density; instability bandwidths and spatial profiles; electron and ion heating--all in agreement with linear, homogeneous theory. Not in agreement with theory are relations between LF, HF and pump intensities. (Modified author abstract) GRA

N74-32194# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMODYNAMICS OF LIQUID METAL MHD GENERATORS
D. D. Kalafati and V. B. Kozlov 9 Feb. 1974 167 p refs Transl. into ENGLISH of the mono. Termodinamika Zhidkometa Uicheskikh MGD-Preobrazovatelei, Moscow, 1972 192 p
(AD-781021; FSTC-HT-23-1306-73) Avail: NTIS CSCL 10/2

The book is devoted to the thermodynamics of the magnetohydrodynamic method of conversion of thermal energy into electrical, using liquid metal working fluids. The prospects for use of liquid metal MHD converters in transportation and stationary power engineering, based on nuclear sources, are set forth. Possible thermodynamic cycles, the fields of their use and the basic features of the heat circuits are discussed. A thermodynamic analysis of possible liquid metal MHD converter cycles is carried out, methods of increasing their efficiency are pointed out and analytical solutions are obtained for a number of optimization problems. A section of the book is devoted to prospects for use of the liquid metal MHD converter built-on units to steam turbine installations in a binary energy cycle for stationary atomic electric power stations. (Modified author abstract) GRA

N74-32195# Army Foreign Science and Technology Center, Charlottesville, Va.
DEVELOPMENT OF AN ELECTRICAL DISCHARGE IN GAPS WITH GREAT OVERVOLTAGE AT LOW AIR PRESSURE
Yu. I. Bychkov, V. V. Osipov, Yu. A. Kurbatov, and A. G. Filonov 8 Aug. 1973 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), v. 128, no. 1, 1973 p 61
(AD-781157; FSTC-HT-23-1841-73) Avail: NTIS CSCL 20/9

The physical processes responsible for breakdown of gas gaps with overvoltages of a few percent have been studied in a number of works both oscillographically and optically. Theoretical calculations have shown that known experimental facts are explained well by the theory of Townsend avalanche generation. In the present work, the authors studied the development of a discharge in gaps of 1-6 cm with overvoltages of 2-20 times, and also measured the time characteristics, both the discharge delay time (t sub d), the time of switching to the 0.5 (U sub 0) level and the duration of the step as functions of the electric field voltage. GRA

N74-32196# Army Foreign Science and Technology Center, Charlottesville, Va.
GAS ELECTRONICS
G. V. Spivak 1 Apr. 1974 22 p refs Transl. into ENGLISH from Raz. Fiz. Rossii (USSR), v. 2, 1970
(AD-781159; FSTC-HT-23-570-73) Avail: NTIS CSCL 20/9

A brief historical survey is given of work which was performed in the Soviet Union in the field of the physics of the gas discharge, with respect to the elementary processes originating in the passage of an electrical current through gases, and related problems. Early work in the investigation of the discharge is enumerated, with respect to the establishment of gas conductivity. Investigations which laid the foundation of the development of theoretical concepts of plasma are described, and also work performed in recent years. Works are considered which are devoted to the behavior of plasma in a magnetic field, plasma diagnostics, and various types of discharges. (Modified author abstract) GRA

N74-32197# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
PULSED INERT GAS PLASMA MODEL
A. P. Passamante and G. D. Ferguson 2 May 1974 26 p refs
(AD-780717; NADC-74009-20) Avail: NTIS CSCL 13/1

The report presents a spectral radiant emission model for the pulsed inert gas plasma arc lamp. The model is based on Kirchoff's law and NAVAIRDEVCEN evolved empirical data. Included in the discussion are some pertinent plasma arc parameters such as temperature, resistivity, collision frequency and their relation to arc current density. Author (GRA)

N74-32198# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
PLASMA ENGINEERING INSTABILITIES, PARTIAL DELIVERY NR. 1 OF THE ENGINEERS HANDBOOK ON PLASMA INSTABILITIES
Ferdinand F. Cap Mar. 1974 39 p refs
(Contract F44620-72-C-0016; AF Proj. 9752)
(AD-781137; AFOSR-74-0717TR) Avail: NTIS CSCL 20/9

The report is the first part of an Engineer's Handbook on plasma instabilities and their use, control, stabilization and engineering application. The book will be necessary for design and feasibility studies of thermonuclear fusion and other plasma engineering devices. The first delivery describes the many useful technological applications of plasma and fusion devices, as well as the aim, purpose and scope of the book. (Modified author abstract) GRA

N74-32199# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DESIGN AND CONSTRUCTION OF TORMAC 4, A TOROIDAL, BI-CUSP PLASMA CONTAINMENT DEVICE Physical Sciences Research Papers
Charles C. Gallagher and Morton A. Levine 6 Mar. 1974 25 p refs
(AF Proj. 8659)
(AD-781038; AFCRL-PSRP-590AFCRL-TR-74-0122) Avail: NTIS CSCL 20/9

Tormac 4 features the production, containment, and heating of plasma within a 48 cm O.D. toroidal chamber. The plasma has a predicted shield-shaped cross section, an included toroidal magnetic field component, and is contained by a two-pole cusp magnetic fluid comprised of both toroidal and poloidal components. The principal plasma heating is provided by an additional magnetic field component at 0.7 MHz. An electrolytic, analog tank facilitates the coil design and indicates that 18 kJ is sufficient to produce a uniform 6 kG on the plasma surface. An integral winding system for the poloidal and toroidal field coils minimizes coupling problems and simplifies insulation requirements. Single turn coils for preionization and heating are applied external to the poloidal-toroidal windings, and the whole device is reinforced with PVC plates and steel tie rods. (Modified author abstract) GRA

N74-32200# ARO, Inc., Arnold Air Force Station, Tenn.
ELECTRON DENSITY PROFILE MEASUREMENTS Final Report, 1 Nov. 1972 - 31 May 1973
Joseph A. Sprouse and J. D. Few Jun. 1974 40 p refs Sponsored by AEDC
(AF Proj. 5730; ARO Proj. RF234)

(AD-781064; ARO-ETF-TR-74-17; AEDC-TR-74-40) Avail: NTIS CSCL 20/9

Electron density profiles of a low density supersonic argon plasma were obtained using 35-GHz microwave attenuation data and spectral intensity measurements of the 4158- and 6032-A argon emission lines. The integrated profile data from the spectral intensity and microwave attenuation measurements were inverted to local values of the emission coefficient and absorption coefficient, respectively, using an Abel inversion technique. The profile data and results of the inversion are presented. Author (GRA)

N74-32201# United Aircraft Corp., East Hartford, Conn. Research Labs.

RESEARCH ON PLASMA PRODUCED BY LASER-SOLID INTERACTION AND LASER PRODUCED PLASMA FOR THERMONUCLEAR REACTORS Final Report, 1 Apr. 1967 - 31 Mar. 1974

James T. Woo, Walter J. Fader, Donald H. Polk, and Alan F. Haught 31 May 1974 64 p refs
(Contract F44620-67-C-0082; AF Proj. 9752)
(AD-781127; UARL-N950556-1; AFOSR-74-0961TR) Avail: NTIS CSCL 20/9

The properties of hot, dense plasmas produced by laser irradiation of an isolated solid particle suspended in vacuum have been investigated and studies made of the use of such plasmas confined within a mirror magnetic field as the target for an energetic neutral beam to form a steady state fusion plasma. Theoretical analysis of the mechanism of plasma production and the role of local ionization and recombination on the properties of the afterglow plasma were performed and found to be in excellent agreement with experimental measurements of the time history of the plasma properties obtained from charge collectors, mass spectrometer and line radiation diagnostics. Survey calculations were used to develop empirical formulas relating the irradiating laser characteristics to the properties of the resulting plasma over a wide range of initial particle size and laser heating conditions. (Modified author abstract) GRA

N74-31819 Princeton Univ., N.J. Plasma Physics Lab.

LABORATORY EXPERIMENTS ON PARAMETRIC INSTABILITIES AND PLASMA HEATING IN A MAGNETIC FIELD

M. Porkolab, V. Arunasalam, and N. C. Luhmann, Jr. *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 16 p refs (For availability see N74-31812 21-13)
(Contract AT(11-1)-3073)

N74-31828 Oxford Univ. (England). Dept. of Theoretical Physics.

PLASMA MECHANISMS FOR PULSAR EMISSION

J. W. Buckee, S. Grounds, L. C. M. Miranda, and D. TerHaar *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 8 p refs (For availability see N74-31812 21-13)

N74-31833 Norwegian Inst. for Air Research, Kjeller.

INTRODUCTORY SURVEY: NONLINEAR EFFECTS IN PLASMA RESONANCES AND ION SHEATH

Kristen Folkstad *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 8 p refs (For availability see N74-31812 21-13)

N74-31836 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).

MODIFICATION OF THE PLASMA IMPEDANCE OF AN ANTENNA DUE TO ION SHEATH INDUCED NONLINEARITIES

H. Thiemann, R. Kist, E. Neske, and K. Rebstock *In* AGARD Nonlinear Effects in Electromagnetic Wave Propagation May 1974 9 p refs (For availability see N74-31812 21-13)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-32202# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

LOW TEMPERATURE HEAT CAPACITIES OF SPHALERITE AND WURTZITE

J. M. Stuve 1974 11 p refs
(BM-RI-7940) Avail: NTIS HC $4.00

Low-temperature adiabatic heat-capacity determinations were investigated in the temperature range from 5 to 300 K for the two crystalline modifications of zinc sulfide, sphalerite and wurtzite. The entropy at 298.15 K of sphalerite was evaluated as 14.02 + or - 0.04 cal/deg mole and wurtzite, 14.06 + or - 0.04 cal/deg mole. Author

N74-32203*# Radio Corp. of America, Princeton, N.J.

DESIGN, PROCESSING, AND TESTING OF LSI ARRAYS FOR SPACE STATION Quarterly Technical Report, 1 Jan. - 31 Mar. 1974

W. C. Schneider and R. J. Hollingsworth May 1974 22 p ref
(Contract NAS12-2207)
(NASA-CR-120224; PRRL-74-CR-41; QTR-13) Avail: NTIS HC $4.25 CSCL 20L

The development of a low power, high performance MOS 256-bit random ascess memory with beam leads is discussed. Beam lead process development on silicon-on-sapphire (SOS) is also discussed, and initial electrical results on beam lead SOS TA5388 devices are presented. A comparison of the beam leaded 256-bit RAM (TA6567) layout is made with the non-beam leaded version (TA6473). Author

N74-32204# Cornell Univ., Ithaca, N.Y. Material Science Center.

SQUID TECHNIQUES. 1: OBTAINING RELIABILITY IN POINT CONTACT SQUID'S

R. A. Buhrman, J. E. Lukens, L. D. Jackel, S. F. Strait, and J. M. Warlaumont 1 Jun. 1974 21 p refs
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-779903; MSC-2224; TR-17; TR-341) Avail: NTIS CSCL 20/12

Stable and permanent niobium point contact SQUIDs have been fabricated by using oxidized niobium screws to form the point contact. The reliability of these devices is further ensured by a simple and versatile environmental shielding procedure. Over a period of five years there have been no failures of such SQUIDs in our laboratory. The signal-to-noise performance of these SQUIDs is quite good. Author (GRA)

N74-32205# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.

A REPRESENTATION OF ELASTIC-VISCOPLASTIC STRAIN-HARDENING BEHAVIOR FOR GENERALIZED STRAINING HISTORIES Interim Report

S. R. Bodner and Y. Partom Apr. 1974 26 p refs
(Grant AF-AFOSR-2607-74; AF Proj. 6813; AF Proj. 9782)
(AD-779948; MED-45; AFOSR-74-0867TR; SR-3) Avail: NTIS CSCL 20/12

A theory of elastic-viscoplastic, strain-hardening material behavior has been developed which is motivated in part from concepts of dislocation dynamics. The basis of the formulation is the separation of the total deformation rate into elastic (geometrically reversible) and inelastic (geometrically irreversible) components at all stages of loading and unloading. The constitutive equations are relations between the deformation rate components and state variables which, in the present stage of formulation, are the stress and the total plastic work which is introduced as the measure of strain-hardening. The same equations hold at all stages of deformation which makes the formulation suitable for computer solution of structural problems involving complicated loading histories. Some examples are given illustrating the application of the constitutive equations to variable straining histories and to structural problems. The description of the anelastic properties of materials by means of the general formulation is also discussed. Author (GRA)

N74-32206# IBM Watson Research Center, Yorktown Heights, N.Y.

EXPERIMENTAL AND THEORETICAL PHYSICS Final Report, 13 May - 31 Dec. 1973

L. Esaki 31 Dec. 1973 6 p
(Contract DAHC04-72-C-0025)
(AD-779535) Avail: NTIS CSCL 20/2

During this period, considerable effort is made to bring the present computer-controlled molecular-beam epitaxy system to final perfection. Major improvements in effusion ovens, substrate holders, additional liquid nitrogen shrouds, etc., in the epitaxy system are made. GRA

N74-32207# Rensselaer Polytechnic Inst., Troy, N.Y. Mechanics Div.
NONLINEAR ELECTROELASTIC EQUATIONS CUBIC IN THE SMALL FIELD VARIABLES
H. F. Tiersten May 1974 26 p refs
(Contract N00014-67-A-0117-0007; NR Proj. 017-504)
(AD-780893; TR-10) Avail: NTIS CSCL 20/12

The nonlinear differential equations and boundary conditions containing terms up to cubic in the small field variables are obtained from general rotationally invariant nonlinear electroelastic equations derived previously. The electroelastic equations cubic in the small field variables are considerably more tractable than the general electroelastic equations and are applicable in the description of such phenomena as the dependence of wave velocities on wave amplitudes and resonant frequencies on vibration amplitudes in addition to a host of other nonlinear phenomena. The nonlinear constitutive equations for an isotropic purely elastic solid containing terms up to cubic in the small mechanical displacement gradients are presented. The nonlinear equations for the extensional motion of thin isotropic plates containing terms up to cubic in the small mechanical displacement gradients in the plane of the plate are obtained and the influence of the vertical inertia is included, in addition to the extensional stiffness and inertia, when the plating is attached to an electroelastic solid. Author (GRA)

N74-32208# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF POSSIBILITIES FOR IMPROVEMENT IN STABILITY OF PHOTOELECTRIC CHARACTERISTICS OF IRRADIATED SILICON P-N JUNCTIONS
G. M. Grigoreva 10 Jan. 1973 10 p refs Transl. into ENGLISH from Nauka Tekh. (USSR), 1970 p 167-173
(AD-780999; FSTC-HT-23-1436-72) Avail: NTIS CSCL 20/12

Methods are considered for increasing the stability of photoconverters operating in the conditions of hard radiation action. One of the methods in question is thermal annealing of the irradiated devices. A change is considered in the process of annealing of the spectral distribution of photosensitivity and the diffusion length of the minority carriers in the base of irradiated n-p type photoconverters. Another possibility for assuring radiation resistance is doping them with lithium. The results are presented of irradiation and low-temperature annealing of p-a type photoconverters with an impurity of lithium and various concentrations of oxygen. In the case when the content of oxygen in silicon is small (- 10 to the 17th power/cc) devices with an impurity of lithium reveal an extremely high resistance to irradiation. The ability of lithium to neutralize recombination centers in silicon having a nonradiation origin is also shown.
Author (GRA)

N74-32209# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
THE 2-6 AND 3-5 HETEROSTRUCTURES FOR OPTOELECTRONIC APPLICATIONS Final Report, 1 May - 31 Oct. 1973
T. C. Lim Feb. 1974 31 p refs
(Contract F33615-73-C-5154; AF Proj. 7371)
(AD-779921; SC552-7FR; AFML-TR-74-30) Avail: NTIS CSCL 20/12

The initial work of Yim and Stofko demonstrated that good quality epitaxial films of ZnS and ZnSe could be achieved by chemical vapor phase deposition (CVD). The purpose of this work is to conduct further exploratory research using CVD aimed at elucidating optimum growth and doping conditions with the goal of producing controlled dopant characteristics. Results on dopants such as Cu, Ga, and Al are presented. It is found that in order to achieve routinely a low resistivity (rho - one ohm-cm) of n-type ZnSe film, the gallium-to-zinc ratio has to be about 25%. Such a result has never been previously obtained in open-tube vapor-phase-epitaxy. These films were grown on highly-insulating ZnSe substrates, p--GaAs, and p-GaAs substrates. Preliminary results on graded heterostructures of InAs(1-x)P(x) for lightemitting or detector applications are also discussed. (Modified author abstract) GRA

N74-32210# Naval Research Lab., Washington, D.C.
CAPILLARITY-LIMITED STEADY-STATE DENDRITIC GROWTH. PART 1: THEORETICAL DEVELOPMENT Semifinal Report, Oct. 1972 - Oct. 1973
Gerald E. Nash 28 Mar. 1974 55 p refs
(AD-780781; NRL-7679-Pt-1) Avail: NTIS CSCL 20/2

A set of integro-differential equations describing steady-state nonisothermal dendritic growth is developed via a time-dependent approach. The steady-state equations are studied in detail for the case of isotropic, capillarity-limited growth, and it is shown that the equations assume a form particularly suitable for solution by successive linearization about the known isothermal solution. Of major importance is that the conditions necessary for the existence of a solution to the linearized equations provide a theoretical estimate of the relationship between growth rate and supercooling. Author (GRA)

N74-32211# Naval Research Lab., Washington, D.C.
CAPILLARITY-LIMITED STEADY-STATE DENDRITIC GROWTH. PART 2: NUMERICAL RESULTS Final Report
Gerald E. Nash 28 Mar. 1974 32 p refs
(RR02201)
(AD-780782; NRL-7680-Pt-2) Avail: NTIS CSCL 20/2

The linearized equations describing nonisothermal, steady-state dendritic growth are solved numerically and the relation between growth rate and supercooling is ascertained. The theoretically predicted growth rates agree with those predicted by the modified Ivantsov analysis at high supercoolings and are higher than those predicted by the Bolling-Tiller-Temkin approach (by a factor of 2.3 at low supercoolings). (Modified author abstract) GRA

N74-32212# Westinghouse Electric Corp., Philadelphia, Pa. Research Labs.
HIGH CRITICAL TEMPERATURE-HIGH FIELD SUPERCONDUCTORS Final Report, 1 Jul. 1971 - 30 Jul. 1974
Daniel W. Deis, John R. Gavaler, and William T. Reynolds 1 Jul. 1974 12 p refs
(Contract F44620-71-C-0045; AF Proj. 9764)
(AD-781135; Rept-74-9J2-HICON-R1; AFOSR-74-0989TR) Avail: NTIS CSCL 20/12

Investigations of new bulk and thin film conductor materials with the A-15 structure have yielded several new high transition temperature compounds. The most significant of these was thin film niobium-germanium prepared by a new sputtering technique. Under the proper sputtering conditions films have been deposited with the highest transition temperature, 23K, of any presently known superconductor. In addition, techniques and apparatus have been devised, constructed and tested for the assembly, consolidation, cold drawing and heat treatment of composite multifilamentary conductors employing niobium tin and vanadium gallium. The superconducting and metallurgical properties of a number of these conductors were extensively investigated.
Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-32213*# Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF PROPELLANT FLOW CONTROL SYSTEM
A. A. Liebman Nov. 1973 84 p
(Contract NAS3-14390)
(NASA-CR-134510; R-9395) Avail: NTIS HC $7.25 CSCL

21I

Mechanical, electromechanical, and fluidic concepts were studied as propellant flow control system for oxygen/hydrogen attitude control thrusters. A mechanical flow controller was designed fabricated, and tested with hydrogen, oxygen, and nitrogen over a range of inlet pressures and temperatures. Results of these tests are presented along with a discussion of a flight-weight design. Also presented are recommendations for further design and development. A detailed coverage of the fluidics investigation is included. Author

N74-32214*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

DETERMINATION OF THE EFFECTS OF NOZZLE NONLINEARITIES UPON NONLINEAR STABILITY OF LIQUID PROPELLANT ROCKET MOTORS Annual Report, 1 Aug. 1973 - 31 Jul. 1974

Ben T. Zinn, Eugene A. Powell, and M. S. Padmanabhan 31 Jul. 1974 30 p refs

(Grant NGR-11-002-179)

(NASA-CR-139634) Avail: NTIS HC $4.50 CSCL 21I

The research is reported concerning the development of a three-dimensional nonlinear nozzle admittance relation to be used as a boundary condition in the nonlinear combustion instability theories for liquid propellant rocket engines. The derivation of the nozzle wave equation and the application of the Galerkin method are discussed along with the nozzle response. F.O.S.

N74-32215# Advisory Group for Aerospace Research and Development, Paris (France).

RADIATION COOLING OF PROPULSIVE NOZZLES [LE REFROIDISSEMENT PAR RAYONNEMENT DES TUYERES PROPULSIVES]

J. J. Bernard (Paris Univ.) and J. Genot (ONERA, Paris) May 1974 51 p refs In FRENCH

(AGARD-AG-184(fr); AGARDograph-184) Avail: NTIS HC $5.75

In the study of the revolution of propulsive nozzles, calculations were made of heat conduction as a function of exchange between isothermal lines when any line is parallel to the revolving surface or slightly parallel to the inclined sections of the plane. Numerical results are presented in the form pf universal functions of geometric parameters of the mederian. For the schematic configuration of the more usual nozzle the direct values of transfer functions are given. Transl. by E.H.W.

N74-32216*# TRW Systems Group, Redondo Beach, Calif.

STUDY OF MONOPROPELLANTS FOR ELECTROTHERMAL THRUSTERS. EVALUATION TEST PROGRAM TASK SUMMARY REPORT Interim Report, Aug. 1973 - Feb. 1974

J. D. Kuenzly Mar. 1974 84 p refs

(Contract NAS5-23202)

(NASA-CR-139072; TRW-22409-6014-RU-00) Avail: NTIS HC $7.25 CSCL 21I

An electrothermal thruster designed for operation with MIL-grade hydrazine is suitable for operation with propellants having lower freezing points. These propellants are 76% hydrazine - 24% hydrazine azide, Aerozine-50, 50% hydrazine - 50% monomethylydrazine, and a TRW-formulated mixture of 35% hydrazine - 50% monomethylhydrane - 15% ammonia. A steady-state specific impulse of 200 sec was exceeded by all propellants. A pulse-mode value of 175 sec specific impulse was exceeded by the azide blend for pulse widths greater than 50 ms and was met by the carbonaceous propellants for pulse widths greater than 100 ms. Longer residence times were required for the carbonaceous propellants; the original thruster design was modified by increasing the characteristic chamber length and density of screen packing. A substantial amount of thermal energy must be supplied to initiate decomposition of propellants containing unsymmetrical-dimethylhydrazine and monomethylhydrazine. The rate controlling factor appeared to be the endothermic removal of methyl radicals. Author

N74-32217# TRW Systems Group, Redondo Beach, Calif.

DEVELOPMENT OF A ZERO-G GAUGING SYSTEM, VOLUME 1 Final Report, 16 Jun. 1972 - 20 Dec. 1973

Frank E. Bupp Jan. 1974 242 p refs

(Contract F04611-71-C-0010)

(AD-779915; TRW-16740-6003-RU-00-Vol-1; AFRPL-TR-74-5-Vol-1) Avail: NTIS CSCL 21/9

Nucleonic techniques using continual gamma-ray emission phenomena were extensively analyzed in the application of gauging (storable) propellants in the Space Shuttle Vehicle Orbital Maneuvering System (OMS) tanks when under zero-gravity conditions. Parametric analyses were used to identify viable gauging concepts which were, in turn, subjected to subsystem and engineering tradeoffs. Based on these tradeoffs, a flight-type nucleonic gauging system was designed, fabricated and tested. (Modified author abstract) GRA

N74-32218# Stanford Research Inst., Menlo Park, Calif.

INVESTIGATION OF LOW-VELOCITY DETONATION PHENOMENA IN LIQUID MONOPROPELLANTS AND EXPLOSIVES Final Report

Michael Cowperthwaite and David C. Erlich Feb. 1974 68 p refs

(Contract F44620-73-C-0034; AF Proj. 6813; SRI Proj. PYU-2383)

(AD-779802; AFOSR-74-0801TR) Avail: NTIS CSCL 19/4

Theoretical and experimental studies were conducted to gain a basic understanding of low-velocity detonation (LVD) in confined energetic liquids. The main objective of the theoretical study was to develop satisfactory models for the initiation and propagation of LVD. LVD was modeled as a reactive shock discontinuity propagating in a liquid cavitated by liquid-wall interactions. A study of Hugoniot curves and numerical calculations on burning bubbles were undertaken to determine the amount of reaction required to support the wave. (Modified author abstract) GRA

N74-32219# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

HIGH TEMPERATURE HYDROCARBON FUELS RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR ON FUEL AFFB-14-70 Final Report, Jul. 1970 - Sep. 1972

Royce P. Bradley, Richard Bankhead, and Warren E. Bucher Apr. 1974 142 p refs

(AF Proj. 3048)

(AD-781066; AFAPL-TR-73-95) Avail: NTIS CSCL 21/4

Hydrocarbon fuels tend to form deposits in the thermal environment associated with high mach number flight. The Advanced Aircraft Fuel System Simulator provides thermal stability data on fuels which are used to determine aircraft fuel system design criteria, operational limits of fuels, and to aid in the development of small-scale thermal stability test devices. Fuel AFFB-14-70, the seventh fuel in a series, was tested under cyclic and steady-state conditions. Steady-state manifold tests were run to determine the effect of dissolved oxygen on thermal stability. The results of tests using manifold tubes with widely different surface finishes are reported. (Modified author abstract) GRA

N74-32220# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.

EXPERIMENTAL STUDY OF THE COMPOSITE SOLID PROPELLANT DEFLAGRATION PROCESS ON A FUNDAMENTAL LEVEL Final Report, 15 Nov. 1972 - 15 Sep. 1973

Robert F. McAlevy, III and Richard B. Cole Dec. 1973 8 p refs

(Contract N00014-67-A-0202-0035)

(AD-780967; ME-RT-73006) Avail: NTIS CSCL 21/9

Two efforts are reported as a continuation and termination of previous work: (1) modelling of the deflagration of ammonium-perchlorate(AP)-oxidized composite solid propellants, (2) measurements of linear-pyrolysis rates of pure and catalyzed AP. Modeling efforts led to development of a new comprehensive model of AP composite propellant burning. The model is termed the modified granular-diffusion-flame model. Linear pyrolysis experiments corroborated earlier data by another experimenter. New pyrolysis-rate measurements were made with catalyzed AP and with different radiometric wavelengths for surface-temperature measurement. Interpretation of these results was cut short by program termination. Author (GRA)

N74-32221# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PHYSICO-CHEMICAL PRINCIPLES OF THE FORMATION OF DEPOSITS IN JET FUELS
G. F. Bolshakov 9 Apr. 1974 293 p refs Transl. into ENGLISH of the book "Fiziko-Khimicheskie Osnovy Obrazovaniya Osadkov v Reaktivnykh Toplivakh" USSR, 1972 231 p
(FTD Proj. T69-04-06)
(AD-781164; FTD-MT-24-416-74) Avail: NTIS CSCL 21/4

Contents: The formation of sediment in fuels which do not contain heteroorganic compounds; The formation of sediment in fuels containing heteroorganic compounds; Methods of obtaining prospective jet fuels. GRA

N74-32222# Rockwell International Corp., McGregor, Tex.
MULTIPLE-FLAME COMBUSTION MODEL FORTRAN 4 COMPUTER PROGRAMS Final Report
G. D. Sammons, D. K. Barrington, and C. H. Burnside 8 Mar. 1974 90 p refs
(Contract F44620-72-C-0046; AF Proj. 9711)
(AD-781128; R-4827; AFOSR-74-0985TR) Avail: NTIS CSCL 21/9

Several investigators have formulated competing-flame models describing composite solid propellant combustion. This report covers Mr. G. D. Sammons; competing-flame modeling efforts. His papers describing the model are appended. This report describes and lists the FORTRAN IV computer program which is the practical outcome of any modeling effort. Included is the solution of an example problem--estimation of the burning rate of a low-smoke HTPB propellant. How the necessary input values are obtained and how they are input is discussed in detail. Finally, the computer solution printout is depicted. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-32223*# Rocketdyne, Canoga Park, Calif.
OPERATING MANUAL FOR COAXIAL INJECTION COMBUSTION MODEL Final Report
R. D. Sutton, M. D. Schuman, and W. D. Chadwick Apr. 1974 452 p refs
(Contract NAS8-29664)
(NASA-CR-129031) Avail: NTIS HC $25.75 CSCL 21H

An operating manual for the coaxial injection combustion model (CICM) is presented as the final report for an eleven month effort designed to provide improvement, to verify, and to document the comprehensive computer program for analyzing the performance of thrust chamber operation with gas/liquid coaxial jet injection. The effort culminated in delivery of an operation FORTRAN IV computer program and associated documentation pertaining to the combustion conditions in the space shuttle main engine. The computer program is structured for compatibility with the standardized Joint Army-Navy-NASA-Air Force (JANNAF) performance evaluation procedure. Use of the CICM in conjunction with the JANNAF procedure allows the analysis of engine systems using coaxial gas/liquid injection. Author

N74-32224*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME ASPECTS OF FLOX-METHANE ROCKET ENGINE THROTTLING
Daniel E. Sokolowski, Ned P. Hannum, and Edwin J. Seigwarth Washington Sep. 1974 29 p refs
(NASA-TM-X-3094; E-7911) Avail: NTIS HC $3.25 CSCL 21H

Four injector designs and two chamber profiles were experimentally evaluated for structural integrity, combustion efficiency, and resistance to combustion instabilities. Vacuum thrust measurements were used as a primary measure of combustion efficiency. Stability rating to test the sensitivity of the injectors to high frequency combustion was conducted, but not extensively. To map the boundary between stable operation and chugging instability, chamber pressure was throttled downward from 689.5 to 206.9 kN/sq m abs (100 to 30 psia). Best operational results were obtained with an injector configuration having no hydraulic swirlers, a 0.00102-m (0.040-in.) recessed FLOX tube, and a nonflared exit in the methane annulus. This injector design exhibited stable combustion and good integrity of hardware, and it exceeded the design goal efficiency (88 percent) at the 10 to 1 throttled condition. Author

N74-32225*# McDonnell-Douglas Corp., Long Beach, Calif.
LOW-SPEED TEST OF TRANSLATING LIP AXISYMMETRIC INLETS FOR SUBSONIC TRANSPORTS Final Report
P. A. Henne Washington NASA Sep. 1974 56 p refs Sponsored by NASA
(NASA-CR-2467) Avail: NTIS HC $3.75 CSCL 21E

Translating lip, axisymmetric inlets have been tested at freestream Mach numbers between 0.0 and 0.30 and at angles of attack between 0 and 90 degrees. Three isolated inlet models were tested. One model represented the inlet geometry at cruise, that is, with no lip translation. The other two models had forward translating lips with different contours. The low forward speed inlet angle-of-attack capability with the translating lip was increased more than twenty degrees over the basic untranslated lip configuration at the higher inlet airflows. The static inlet performance with the translating lip was also greatly improved. The design translation distance, defined by potential flow analysis, was near optimum. Author

N74-32226# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
EXPERIMENTAL INVESTIGATIONS ON THERMAL SELF-IGNITION OF TURBULENT DIFFUSION FLAMES AT HIGH VELOCITIES Ph.D. Thesis - Tech. Hochschule, Aachen
Friedmann Suttrop 22 Jan. 1974 119 p refs In GERMAN; ENGLISH summary
(DLR-FB-74-10) Avail: NTIS HC $9.00; DFVLR, Porz, West Ger. 42 DM

In a combustion tunnel, thermal self-ignition characteristics of turbulent hydrogen diffusion flames were studied at stagnation temperatures up to 1900 K. Mach numbers mainly between 1.5 and 2.2, and static pressures of 0.39 bar and 1 bar respectively. A semiempirical calculating method correlates the measured data to the well-known induction times of the system hydrogen/air including effects of dissociated components of the test air. Results indicate that spontaneous ignition of hydrogen in scramjets will occur at aircraft velocities of about Mach 6 and above. By pre-burning less than 1 percent of the hydrogen, the self-ignition range can be extended substantially towards lower flight Mach numbers. Author (ESRO)

N74-32227# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A-GAS TURBINE ENGINE (T55-L-7C) Interim Report, 1 Jan. 1964 - 1 Jul. 1973
May 1974 21 p
(AD-779958; USAAVSCOM-TR-74-28) Avail: NTIS CSCL 21/5

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distribution can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N74-32228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTACTLESS MEASURING OF VIBRATIONS IN THE ROTOR BLADES OF TURBINES
I. E. Zablotskii, Yu. A. Korostelev, and L. B. Sviblov 23 Apr. 1974 24 p refs Transl. into ENGLISH from Lopatochnye Mashiny i Struynye App. (USSR), no. 6, 1972 p 106-121
(AD-780365) Avail: NTIS CSCL 21/5

A discrete phase method is investigated that instantaneously measures vibration by a stationary sensor. Blade markers are used to determine blade vibration. Photographs show patterns of blade vibration. M.C.F.

N74-32229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DELIVERY OF COOLING AIR TO THE RING CLEARANCE ON THE EFFICIENCY AND DISCHARGE CHARACTERISTIC OF A TURBINE STAGE
F. S. Bedcher and L. M. Ronkin 18 Apr. 1974 10 p refs Transl. into ENGLISH from Energomashinostr. (USSR), no. 9, 1971 p 46-47
(AD-779804; FTD-HT-23-1194-74) Avail: NTIS CSCL 21/5

Aerodynamic factors of air loss in gas turbines are presented. The delivery of cooling air was accomplished in the ring clearance through the slotted channels in the exit edges of the blades. The study concludes that the aerodynamic characteristics of coolable blades can be performed on simple models-flat or annular cascades. M.C.F.

N74-32230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF RESONANCE VIBRATIONS OF VARIED-FREQUENCY ROTOR BLADES OF AN AXIAL FLOW COMPRESSOR
I. E. Zablotskii and R. A. Shipov 17 Apr. 1974 29 p refs Transl. into ENGLISH from Lopatochnye Mashiny i Struynye App. Sb. Statei (USSR), no. 6, 1972 p 131-150
(AD-778520; FTD-HT-23-675-74) Avail: NTIS CSCL 21/5

A study was made of resonance vibrations of a varied frequency rotor of an axial flow compressor with the alternation of blades with higher and lower natural frequencies. Data show that with the excitation of vibrations of the second harmonic of general nonuniform flow, higher stresses are realized on blades with higher natural frequencies; futhermore, in the studied range of values of the airflow rate, an increase in the flow rate coefficient, causes the level of stresses to increase. These and other experimental data obtained are in satisfactory agreement with theoretical and experimental studies carried out earlier.
Author (GRA)

N74-32231# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BLADE BREAK INDICATOR FOR A TURBOMACHINE
I. E. Zablotskii and Yu. A. Korostelev 18 Apr. 1974 6 p Transl. into ENGLISH from Energomashinestroenie (Moscow), no. 7, 1971 p 36
(AD-779834/1; FTD-HT-23-1193-74) Avail: NTIS HC $3.00 CSCL 21/5

An indicator is reported for the monitoring and detection of blade breakage or malfunction. It is shown that a signal is given when the blade is breaking, possibly eliminating loss of power or complete failure of the turbine. A sawtooth diagram is included which illustrates a break in one of the blades. M.C.F.

N74-32232# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLID-PROPELLANT ROCKET ENGINES
A. M. Vinitskii 9 Apr. 1974 445 p refs Transl. into ENGLISH of the book "Raketnye Dvigateli na Tverdom Toplive" Moscow, 1973 348 p
(AD-780834; FTD-MT-24-328-74) Avail: NTIS CSCL 21/8

The book describes the motion of combustion products in the chamber and nozzle of solid-propellant rocket engine. The spreads of intrachamber and output characteristics of RDTT, caused by random and systematic deviations of the loading parameters are analyzed. The effect of the engine and propellant characteristics on the ideal velocity of the rocket is also analyzed. The book also examines the procedure for profiling of nozzles, the motion of two-phase combustion products, and the calculation and design of charges from solid rocket propellants. GRA

N74-32233# United Technology Center, Sunnyvale, Calif.
CASE LINER BOND ANALYSIS Final Report, 15 Nov. 1971 - 21 Jun. 1974
E. C. Francis, L. I. Deverall, C. H. Carlton, H. T. Zitzer, W. G. Knauss, E. B. Becker, and R. S. Dunham Jul. 1974 472 p refs
(Contract F04611-72-C-0010; AF Proj. 3059)
(AD-780642; UTC-2439-FR; AFRL-TR-74-23) Avail: NTIS CSCL 21/8

A second generation finite element computer code was developed with specialized features for accurate evaluation of solid propellant case liner bond regions. The code uses six-term quadratic elements for propellant modeling, special thin liner elements for liner and insulation modeling, and a crack tip element for modeling boots and cracked regions. Mesh generation is automated with variable density spacing and input format is optimized for minimum labor during problem setup. The code contains a rezone feature for selective refining of specific high stress gradient regions and rerunning for maximum accuracy. This new computer code was made available to the solid propellant industry at a computer users course in October 1973. (Modified author abstract) GRA

N74-32234# Teledyne CAE, Toledo, Ohio.
LIFT ENGINE ADVANCED TURBINE BLADE TECHNOLOGY Final Report, 14 Jul. 1972 - 24 Mar. 1973
Apr. 1973 168 p
(Contract N00140-73-C-0075)
(AD-781006; TCAE-1285) Avail: NTIS CSCL 21/5

The objective of the program was to demonstrate the capability for a significant improvement in lift engine thrust-to-weight through an improvement in the turbine rotor blade design. The design was directed at a reduction in turbine weight coupled with an efficient blade cooling system which would reduce cooling bleed flow and provide a potential for increasing turbine inlet temperature. The approach combines the efficiency of an effusion-cooled system with a unique structural design which greatly reduces turbine blade weight. The blade shell design consists of an outer porous skin formed through diffusion bonded layers of Nichrome V screening material, a grid (plenum) plate which distributes air to the porous outer skin, and an orifice plate which controls the flow to the grid plate plenums. The orifice plate also acts as the primary structural member of the blade, avoiding the more common requirement for a central spar. (Modified author abstract) GRA

N74-32235# Bendix Research Labs., Southfield, Mich.
CONTROL OF EMISSIONS FROM LIGHT PISTON ENGINE AIRCRAFT
W. F. Datwyler, A. Blatter, and S. T. Hassan May 1973 207 p refs
(Contract EPA-68-04-0045)
(PB-230900/3; APTD-1521) Avail: NTIS HC $13.50 CSCL 13B

The study was primarily of an experimental nature directed at observing and evaluating the results of applying existing automotive emission control techniques to aircraft piston engines. Attention was restricted to the emissions of unburned hydrocarbons, carbon monoxide, and oxides of nitrogen. Control techniques considered were those primarily used to reduce hydrocarbons and carbon monoxide, since the rich mixtures normally used in aircraft operation inherently lead to low levels of oxides of nitrogen. The general program approach was to select two typical engine configurations, design and implement selected emission control provisions, establish baseline emissions outputs for the standard engines, and determine the effect of the various emission control techniques and systems relative to the baseline values. A Continental O-200 carbureted engine and a Lycoming IO-540 fuel-injection engine were selected for evaluation. (Modified author abstract) GRA

N74-32236# Solar, San Diego, Calif.
LOW EMISSION COMBUSTOR/VAPOR GENERATOR FOR AUTOMOBILE RANKINE CYCLE ENGINES

T. E. Duffy, J. R. Shekelton, R. B. Addoms, and W. A. Compton Oct. 1973 330 p refs
(Contract EPA-68-04-0036)
(PB-230896/3; EPA-460/3-73-004) Avail: NTIS HC $19.50 CSCL 13B

This is the final report on a program to demonstrate a low emission vapor generator for automotive Rankine cycle power plants. Program goals were to design and test a low emission system that required low parasitic power, had compact packaging, high steam generator efficiency and suitable controls for fuel, air and water for the regulation of steam pressure and temperature. A steam generator with an output of 1200 pounds per hour at 1000F and 1000 psia was demonstrated by tests to have weighed emissions below the 1976 emission standards over a simulated driving cycle. GRA

N74-31445 Advisory Group for Aerospace Research and Development, Paris (France).
AN EXPERIMENTAL INVESTIGATION INTO DUPLEX DIGITAL CONTROL OF AN ENGINE WITH REHEAT
J. F. O. Evans and K. A. Helps *In its* Advan. in Control Systems May 1974 14 p (For availability see N74-31429 21-02)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-32237 Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. Fuer Extraterrestrische Physik.
ENERGY SPECTRUM AND EVIDENCE FOR EXTRAGALACTIC ORIGIN OF DIFFUSE GAMMA-RADIATION IN THE MeV-RANGE
V. Schoenfelder and G. Lichti Mar. 1974 17 p refs Submitted for publication
(MPI-PAE/Extraterr-95) Avail: Issuing Activity

Results on the diffuse gamma ray flux between 1.5 and 10 MeV from a balloon borne double Compton telescope are presented. The diffuse flux exceeds a straight line extrapolation from the X-ray range by a factor of 4 at 2.5 MeV. From the constancy of the gamma counting rate from regions of the sky with galactic latitudes, b(II) = 0 deg and b(II) = -30 deg, an extragalactic origin of more than 85% of the measured diffuse flux can be deduced. Author (ESRO)

N74-32238*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SOLAR NEUTRINOS AND THE INFLUENCE OF RADIATIVE OPACITIES ON SOLAR MODELS
T. R. Carson, D. Ezer, and R. Stothers [1973] 8 p refs
(NASA-TM-X-70321) Avail: NTIS HC $4.00 CSCL 03B

Use of new radiative opacities based on the hot Thomas-Fermi model of the atom yields a predicted solar neutrino flux which is still considerably larger than the flux observed in Davis's Cl-37 experiment. Author

N74-32239*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
A NUMERICAL CALCULATION OF OUTWARD PROPAGATION OF SOLAR DISTURBANCES Final Report
S. T. Wu Feb. 1974 88 p refs
(Contract NAS8-25101)
(NASA-CR-120368; UAH-RR-151) Avail: NTIS HC $7.50 CSCL 03B

The responses of the solar atmosphere due to an outward propagation shock are examined by employing the Lax-Wendroff method to solve the set of nonlinear partial differential equations in the model of the solar atmosphere. It is found that this theoretical model can be used to explain the solar phenomena of surge and spray. A criterion to discriminate the surge and spray is established and detailed information concerning the density, velocity, and temperature distribution with respect to the height and time is presented. The complete computer program is also included. Author

N74-32240*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLAR ENERGETIC PARTICLE EVENT WITH He-3/He-4 > 1
V. K. Balasubrahmanyan and A. T. Serlemitsos Jul. 1974 10 p refs Submitted for publication
(NASA-TM-X-70732; X-661-74-233) Avail: NTIS HC $4.00 CSCL 03B

The solar event of 28 May 1968 is reported using the Goddard Cosmic Ray Telescope on OGO-5. The flare associated with the event occurred at 12:48 on 28 May and had importance 1B. About 600 He-3 were detected in the event and the He-3/He-4 equals 1.52 plus or minus 0.1 in the energy range 4-80 MeV/necleon. This is the highest ratio reported so far for any solar event. M.C.F.

N74-32241*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RADIATION FROM THE CRAB NEBULA ABOVE 35 MeV
D. A. Kniffen, R. C. Hartman, D. J. Thompson, G. F. Bignami, C. E. Fichtel, H. Oegelman (Middle East Tech. Univ., Ankara), and T. Tuemer (Middle East Tech. Univ., Ankara) Aug. 1974 11 p refs Submitted for publication
(NASA-TM-X-70734; X-662-74-236) Avail: NTIS HC $4.00 CSCL 03B

Electromagnetic radiation from the Crab nebula were observed, showing that the Crab is unique among strong X-ray sources in that major component in the low energy range (1 to 10 KeV) shows little or no temporal variation. Observations of the Crab above 35 MeV were made with the high energy gamma ray telescope flown on SAS-2. The detector and technique are described in detail. M.C.F.

N74-32242*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO HIGH RESOLUTION VELOCITY VECTOR ANALYZERS FOR COSMIC DUST PARTICLES
Siegfried Aver Aug. 1974 43 p refs Submitted for publication
(NASA-TM-X-70727; X-672-74-226) Avail: NTIS HC $5.25 CSCL 03B

Methods are described to measure velocities and angles of incidence of charged cosmic dust particles with precisions of about 1 percent and 1 degree, respectively. Both methods employ four one-dimensional position-sensitive detectors in series. The first method utilizes a charge-dividing technique while the second utilizes a time-of-flight technique for determining the position of a particle inside the instrument. The velocity vectors are measured although mechanical interaction between the particle and the instrument is completely avoided. Applications to cosmic dust composition and collection experiments are discussed. The range of radii of measurable particles is from about 0.01 to 100 microns at velocities from 1 to 80 km/s. Author

N74-32243*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE DEPENDENCE OF EMISSION MEASURE IN SOLAR X-RAY PLASMAS. 1: NON-FLARING ACTIVE REGIONS
K. J. H. Phillips (NAS-NRC) Jul. 1974 29 p refs Submitted for publication
(NASA-TM-X-70725; X-682-74-220) Avail: NTIS HC $4.50 CSCL 03B

X-ray and ultraviolet line emission from hot, optically thin material forming coronal active regions on the sun may be described in terms of an emission measure distribution function, Phi (T). A relationship is developed between line flux and Phi (T), a theory which assumes that the electron density is a single-valued function of temperature. The sources of error involved in deriving Phi (T) from a set of line fluxes are examined in some detail. These include errors in atomic data (collisional excitation rates, assessment of other mechanisms for populating excited states of transitions, element abundances, ion concentrations, oscillator strengths) and errors in observed line fluxes arising from poorly poorly - known instrumental responses. Two previous analyses are discussed in which Phi (T) for a non-flaring active region is derived. A least squares method of Batstone uses X-ray data of

low statistical significance, a fact which appears to influence the results considerably. Two methods for finding Phi (T) ab initio are developed. The coefficients are evaluated by least squares. These two methods should have application not only to active-region plasmas, but also to hot, flare-produced plasmas. Author

N74-32244*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAVY SOLAR COSMIC RAYS IN THE JANUARY 25, 1971 SOLAR FLARES
Charles J. Pellerin, Jr. Aug. 1974 32 p refs
(NASA-TM-X-70731; X-662-74-231) Avail: NTIS HC $4.75 CSCL 03B

A detailed study of the charge composition of heavy solar cosmic rays measured in the January 25, 1971 solar flare including differential fluxes for the even charged nuclei from carbon through argon is presented. The measurements are obtained for varying energy intervals for each nuclear species in the energy range from 10 to 35 MeV/nucleon. In addition, abundances relative to oxygen are computed for all the above nuclei in the single energy interval from 15 to 25 MeV/nucleon. This interval contains measurements for all of the species and as a result requires no spectral extrapolations. An upper limit for the abundance of calcium nuclei is also presented. These measurements, when combined with other experimental results, enable the energy dependence of abundance measurements as a function of nuclear charge to be discussed. It is seen that at energies above about 10 MeV/nucleon, the variations of abundance ratios are limited to about a factor of 3 from flare to flare, in spite of large variations in other characteristics of these solar events. Author

N74-32245*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CAUSES OF FORBUSH DECREASES AND OTHER COSMIC RAY VARIATIONS
E. Barouch and L. F. Burlaga Jul. 1974 32 p refs Submitted for publication
(NASA-TM-X-70726; X-690-74-224) Avail: NTIS HC $4.75 CSCL 03B

The relationship between neutron monitor variations and the intensity variations of the interplanetary magnetic field is studied, using Deep River data and IMP-series satellite data. In over 80% of the cases studied, identifiable depressions of the cosmic ray intensity are associated with magnetic field enhancements of several hours duration and intensity above 10 gamma. Conversely, each magnetic field enhancement has an identifiable effect (though not necessarily a marked depression) on the cosmic ray intensity. Long lasting Forbush decreases are found to be the consequence of the successive action of several such features. An explanation is presented and discussed. Author

N74-32246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAY LINES FROM SOLAR FLARES
R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) Jul. 1974 43 p refs Presented at IAU/COSPAR Symp. No. 68 on Solar X, Gamma and EUV Radiations, Buenos Aires, 11-13 Jun. 1974 Submitted for publication
(Grant NSF GP-31620)
(NASA-TM-X-70729; X-660-74-228) Avail: NTIS HC $5.25 CSCL 03B

The strongest line, both predicted theoretically and detected observationally at 2.2 MeV, is due to neutron capture by protons in the photosphere. The neutrons are produced in nuclear reactions of flare accelerated particles which also positrons and prompt nuclear gamma rays. From the comparison of the observed and calculated intensities of the lines at 4.4 or 6.1 MeV to that of the 2.2 MeV line, it is possible to deduce the spectrum of accelerated nuclei in the flare region; and from the absolute intensities of these lines, it is possible to obtain the total number of accelerated nuclei at the sun. The study of the 2.2 MeV line also gives information on the amount of He-3 in the photosphere. The study of the line at 0.51 MeV resulting from positron annihilation complements the data obtained from the other lines; in addition it gives information on the temperature and density in the annihilation region. Author

N74-32247*# New Hampshire Univ., Durham. Dept. of Physics.
ANALYSIS OF THE 0.511 MeV RADIATION AT THE OSO-7 SATELLITE Ph.D. Thesis
Philip P. Dunphy Mar. 1974 139 p refs
(Contract NAS5-11054; Grant NGL-30-002-018)
(NASA-CR-139585) Avail: NTIS HC $10.00 CSCL 03B

Observations of the 0.511 MeV positron annihilation, gamma ray on the OSO-7 satellite are presented. Variables which affect the counting rate are discussed. An upper limit flux of .0076 photons/sq cm/sec is obtained for the quiet sun and a positive solar flux of .063(+ or - .0002) photons/sq cm/sec is obtained for the 3B flare of 4 August 1972. The width of this annihilation line gives an upper limit temperature for the annihilation region of approximately 6 million K. An analysis of the line width and position also shows that the contribution to the line from positronium annihilation is less than 100% at the 99% confidence level. An upper limit is also found for an isotropic cosmic flux. Author

N74-32248# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Service Technique d'Etudes de Protection et de Pollution Atmospherique.
DOSIMETRY OF COSMIC RADIATION ON BOARD THE SUPERSONIC TRANSPORT CONCORDE
H. Francois, R. P. Delahaye, P. Simon, G. Portal, H. Kaiser, and P. Durney 1973 12 p refs In FRENCH Presented at the 3d Intern. Congr. of the Intern. Radiation Protection Assoc. Meeting, Washington, D. C., 9 Sep. 1973
(CEA-Conf-2540; Conf-730907-21) Avail: AEC Depository Libraries HC $3.00

Dosimetry of cosmic radiation on-board the French prototype supersonic transport Concorde 001 performed during the aircraft's test flights included the use of nuclear emulsions in which each event is individually analyzed; stacks of nuclear emulsions of varying sensitivity which permit obtaining ionizing-particle distribution as a function of their TEL; thermoluminescent dosimeters; fast-neutron dosimeters; and dose-rate recording systems. The results obtained are reported and the dosimetric problems posed by possible solar flares, and their effects upon flight plans are discussed. Conclusions are drawn relative to the possible dosimetry techniques to be employed in identifying radiation protection problems on-board the SST. Author (NSA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-32249*# Teledyne Brown Engineering, Huntsville, Ala.
THERMAL MAPPING OF THE LUNAR SURFACE Final Report
W. L. Raine Sep. 1973 110 p refs
(Contract NAS8-26343)
(NASA-CR-120367; EE-SSL-1767) Avail: NTIS HC $8.50 CSCL 03B

A program of lunar infrared radiometry which uses large area scanning is described, and procedures for atmospheric attenuation correction and data reduction to temperature by relative radiometry are outlined. Flow charts of the computer data reduction program are shown which contain the astrometric analysis from ephemeral data. The scan data, taken on 10 evenings in 1971 and 1972 in the 10 to 12 micron window, are presented as isothermal contour maps of the lunar disc. More than 160 areas of anomalous thermal emission were found in the lunar darkside data. Eclipse cooling curves, measured in the same wavelength band for 7 lunar regions during the eclipse of February 10, 1971, are also presented. Errors of the scan and eclipse data were calculated from accuracy estimates of the parameters. Author

N74-32250*# Alabama Univ., Huntsville. School of Graduate Studies and Research.

A STUDY OF DYNAMICAL BEHAVIOR OF SPACE ENVIRONMENT Final Report
S. T. Wu Mar. 1974 137 p refs
(Contract NAS8-25750)
(NASA-CR-120375; UAHRR-152) Avail: NTIS HC $10.00 CSCL 03B

Studies have covered a wide range of problems in the space environment, such as the problems of the dynamical behavior of the thermosphere, hydromagnetic wave propagation in the ionosphere, and interplanetary space environment. The theories used to analyze these problems range from a continuum theory of magnetohydrodynamics to the kinetic theory of free molecular flow. This is because the problems encountered covered the entire range of the Knudsen number (i.e., the ratio of mean free path to the characteristic length). Significant results are summarized. Author

N74-32251*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
RESEARCH REVIEW, 1 JANUARY - 31 DECEMBER 1972
1972 229 p refs
(NASA-TM-X-70290) Avail: NTIS HC $14.50 CSCL 03A

Space science projects are reported individually for the period January 1, 1972 through December 31, 1972. The articles, representing both theoretical and experimental study approaches, present highlights of the research, along with graphical diagrams of important results. Subjects range from laboratory astrophysics to balloon-borne infrared astronomy, from lunar studies to stellar evolution, and from planetary atmospheric investigations to climatology. Applications of research for the same period are also reviewed, along with their attendant results. A.A.D.

N74-32252*# Stanford Research Inst., Menlo Park, Calif.
CO2 PHOTODISSOCIATION AND VIBRATIONAL EXCITATION IN THE PLANETARY ATMOSPHERES Final Report, 8 Dec. 1972 - 8 Jul. 1974
Tom G. Slanger 5 Jul. 1974 70 p refs
(Contract NASw-2400; SRI Proj. PYU-2372)
(NASA-CR-139599) Avail: NTIS HC $6.50 CSCL 03B

The principal subjects of investigation were the determination of the CO2 photodissociation quantum yields at the wavelengths from 1200 A to 1500 A, and the efficiency of electronic-to-vibrational energy transfer in the systems O(1D) + CO, N2, CO2 yields O(3P) + CO N2, CO2 vibrational energies. Measurements on the photodissociation quantum yield of CO2 in the 1200-1500 A region show that it is wavelength dependent, and for the six atomic line sources used, the quantum yield varied from 0.2 to 0.8. The data appear to fit the interpretation of stable CO2 bound states mixed with repulsive or predissociating states, since the low quantum yields coincide with the maximum structure in the CO2 absorption spectrum. The first reliable measurements were made on the efficiency of electronic-to-vibrational energy transfer in the systems O(1D)-CO and O(1D)-N2, using a uv resonance fluorescence technique. The O(1D)-CO2 interaction was investigated by infrared techniques. Author

N74-32253*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
OPERATIONS ANALYSIS (STUDY 2.1): SHUTTLE UPPER STAGE SOFTWARE REQUIREMENTS
R. R. Wolfe 15 Jul. 1974 113 p refs
(Contract NASw-2575)
(NASA-CR-139597; ATR-74(7341)-4) Avail: NTIS HC $8.75 CSCL 22A

An investigation of software costs related to space shuttle upper stage operations with emphasis on the additional costs attributable to space servicing was conducted. The questions and problem areas include the following: (1) the key parameters involved with software costs; (2) historical data for extrapolation of future costs; (3) elements of the basic software development effort that are applicable to servicing functions; (4) effect of multiple servicing on complexity of the operation; and (5) are recurring software costs significant. The results address these questions and provide a foundation for estimating software costs based on the costs of similar programs and a series of empirical factors. Author

N74-32254*# TRW Systems, Redondo Beach, Calif. System Evaluation Dept.
APOLLO 16, LM-11 ASCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION
W. G. Griffin Jun. 1974 55 p refs
(Contract NAS9-12330)
(NASA-CR-134366; MSC-07230-Suppl-3;
TRW-20029-H162-RO-00) Avail: NTIS HC $5.75 CSCL 22C

The duty cycle for the LM-11 APS consisted of two firings, an ascent stage liftoff from the lunar surface, and the terminal phase initiation (TPI) burn. APS performance for the first firing was evaluated and found to be satisfactory. No propulsion data were received from the second APS burn; however, all indications were that the burn was nominal. Engine ignition for the APS lunar liftoff burn occured at the Apollo elapsed time (AET) of 175:31:47.9 (hours:minutes:seconds). Burn duration was 427.7 seconds. Author

N74-32255*# Florida Univ., Gainesville. Dept. of Physics and Astronomy.
AN ANALYSIS OF JUPITER DATA FROM THE RAE-1 SATELLITE Final Report, 1 Jul. 1973 - 30 Sep. 1974
Thomas D. Carr 30 Sep. 1974 26 p refs
(Grant NGR-10-005-176)
(NASA-CR-139581) Avail: NTIS HC $4.50 CSCL 03B

The analysis of Radio Astronomy Explorer Satellite data are presented. Radio bursts from Jupiter are reported in the frequency range 4700 KHz to 45 KHz. Strong correlations with Io were found at 4700, 3930, and 2200 KHz, while an equally strong Europa effect was observed at 1300, 900, and 700 KHz. Histograms indicating the relative probability and the successful identification of Jupiter activity were plotted, using automatic computer and visual search techniques. M.C.F.

N74-32256*# State Univ. of New York, Albany. Space Astronomy Lab.
POLARIMETRIC OBSERVATIONS OF COMET KOHOUTEK (1973f) Status Report, 1 Oct. 1973 - 30 Jun. 1974
J. L. Weinberg 28 Aug. 1974 16 p refs
(Grant NGR-33-182-018)
(NASA-CR-139579) Avail: NTIS HC $4.00 CSCL 03B

Radio, optical, and visual observations were made of Comet Kohoutek (1973f) using facilities of the National Radio Astronomy Observatory (NRAO) and of the Hawaii Night Sky Observatory, State University of New York at Albany (SUNYA). Transit observations were made using the NRAO 300 ft radio telescope on six consecutive days beginning November 24, 1973. Observations were carried out in the continuum at 11 cm using the 4-feed system at different position angles. The data were recorded on magnetic tape and were computer reduced. Results were negative, with an rms error of 62 milli flux units, giving an upper limit of 180 mfu for the 11 cm continuum emission from the Comet. This relatively high detection limit resulted from a combination of interference and bad weather that affected these pre-perihelion observations. No observations could be scheduled near or after perihelion. Author

N74-32257# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH GEOPHYSICS, ASTRONOMY, AND SPACE NO. 329
26 Jul. 1974 58 p refs Transl. into ENGLISH from Russian reports
(JPRS-62573) Avail: NTIS HC $6.00

Abstracts are presented along with bibliographic information concerning: astronomy, meteorology, oceanology, and terrestrial geophysics. Space research and the upper atmosphere are also reported. M.C.F.

N74-32258*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IS THERE ANOTHER MAJOR CONSTITUENT IN THE ATMOSPHERE OF MARS?
George P. Wood Aug. 1974 17 p refs
(NASA-TM-X-71999) Avail: NTIS HC $3.00 CSCL 03B

In view of the possible finding of several tens percent of inert gas in the atmosphere of Mars by an instrument on the descent module of the USSR's Mars 6 spacecraft, the likelihood

of the correctness of this result was examined. The basis for the well-known fact that the most likely candidate is radiogenic argon is described. It is shown that, for the two important methods of investigating the atmosphere, earth-based CO2 is infrared absorption spectroscopy and S-band occultation, within the estimated 1 standard deviation uncertainties of these methods about 20% argon can be accommodated. Within the estimated 3 standard deviation uncertainties, more than 35% is possible. It is also stated that even with 35% argon the maximum value of heat transfer rate on the Viking 75 entry vehicle does not exceed the design value. Author

N74-32259*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.
RADAR STUDIES OF THE PLANETS Final Progress Report
R. P. Ingalls, G. H. Pettengill, A. E. E. Rogers, P. B. Sebring, ed., and I. I. Shapiro 29 Aug. 1974 12 p refs
(Grant NGR-22-174-003)
(NASA-CR-139580) Avail: NTIS HC $4.00 CSCL 03A

The radar measurements phase of the lunar studies involving reflectivity and topographic mapping of the visible lunar surface was ended in December 1972, but studies of the data and production of maps have continued. This work was supported by Manned Spacecraft Center, Houston. Topographic mapping of the equatorial regions of Mars has been carried out during the period of each opposition since that of 1967. The method comprised extended precise traveling time measurements to a small area centered on the subradar point. As measurements continued, planetary motions caused this point to sweep out extensive areas in both latitude and longitude permitting the development of a fairly extensive topographical map in the equatorial region. Radar observations of Mercury and Venus have also been made over the past few years. Refinements of planetary motions, reflectivity maps and determinations of rotation rates have resulted. Author

N74-32260*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POST-FLIGHT DIFFERENTIAL CORRECTION ANALYSIS USING VINTI'S SPHEROIDAL METHOD FOR THE SMALL ASTRONOMY SATELLITE ORBIT
Harvey Walden Apr. 1974 58 p refs Submitted for publication
(NASA-TM-X-70720; X-582-74-207) Avail: NTIS HC $6.00 CSCL 22A

The results of an intensive analysis of a differential orbit improvement method utilizing observational data for a 550-kilometer altitude, near-circular, near-equatorial satellite orbit are presented. Observations of the Small Astronomy Satellite (SAS-1) are in the form of direction cosines as measured at two ground interferometer tracking stations near the Equator during the first 22 orbital revolutions (approximately 37 hours) after launch of the spacecraft. Numerical results, in both tabular and graphical form, are displayed for numerous iterated fittings of various observational arcs by differential correction of the orbital elements. Parameters varied in these comparative cases include the time duration of the observational data block, the number of pairs of direction cosine data and the number of tracking station passes included in the solution, the distribution of such passes between the two available tracking stations, and the acceptance criterion for the observational residuals in the least squares fitting procedure. It was found that three observational pairs of direction cosine data, the minimum number possible for a uniquely determined solution in theory, are sufficient to promote covergence to an accurate solution, if properly selected. Author

N74-32261*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO ASTRONOMY EXPLORER-B POSTLAUNCH ATTITUDE OPERATIONS ANALYSIS
R. D. Werking, R. Berg, K. Brokke, T. Hattox, G. Lerner, D. Stewart, and R. Williams Jul. 1974 143 p refs
(NASA-TM-X-70728; X-581-74-227) Avail: NTIS HC $10.25 CSCL 22C

The attitude support activities of the Radio Astronomy Explorer-B are reported. The performance of the spacecraft hardware and software are discussed along with details of the mission events, from launch through main boom deployment. Reproductions of displays are presented which were used during support activities. The interactive graphics proved the support function by providing the quality control necessary to ensure mission success in an environment where flight simulated ground testing of spacecraft hardware cannot be performed. M.C.F.

N74-32262*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EPHEMERIS DATA AND ERROR ANALYSIS IN SUPPORT OF A COMET ENCKE INTERCEPT MISSION
Donald K. Yeomans Jun. 1974 37 p refs Prepared by Computer Sci. Corp., Silver Spring, Md.
(Contract NAS5-11999)
(NASA-TM-X-70718; X-581-74-185) Avail: NTIS HC $5.00 CSCL 03B

Utilizing an orbit determination based upon 65 observations over the 1961 - 1973 interval, ephemeris data were generated for the 1976-77, 1980-81 and 1983-84 apparitions of short period comet Encke. For the 1980-81 apparition, results from a statistical error analysis are outlined. All ephemeris and error analysis computations include the effects of planetary perturbations as well as the nongravitational accelerations introduced by the outgassing cometary nucleus. In 1980, excellent observing conditions and a close approach of comet Encke to the earth permit relatively small uncertainties in the cometary position errors and provide an excellent opportunity for a close flyby of a physically interesting comet. Author

N74-32263*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METER-WAVELENGTH OBSERVATIONS OF PULSARS USING VERY LONG BASELINE INTERFEROMETRY Ph.D. Thesis - Maryland Univ., College Park
Nancy R. Vandenberg Jul. 1974 200 p refs Prepared in cooperation with Maryland Univ., College Park
(Grants NGL-21-002-29; NGL-21-002-033)
(NASA-TM-X-70719; X-693-74-203) Avail: NTIS HC $13.00 CSCL 03A

The results of an investigation of the angular structure imposed on pulsar radiation due to scattering in the interstellar medium are presented. The technique of very-long-baseline interferometry was used to obtain the necessary high angular resolution. The interferometers formed by the Arecibo, NRAO, and Sugar Grove telescopes were used at radio frequencies of 196, 111, and 74 MHz during seven separate observing sessions between November 1971 and February 1973. A crude visibility function for the Crab nebular pulsar was obtained along with the correlated pulse profile. The technique of differential fringe phase was used to show that the pulsar and the compact source in the Crab nebula are coincident to within 0.001 arcsec which corresponds to aproximately 2 a.u. at the distance to the nebula. The ratio of pulsing to total flux, and the fringe visibility of the time-averaged pulsing flux are also discussed, and apparent angular sizes of the pulsars were measured. Author

N74-32264*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
STUDY OF EPHEMERIS ACCURACY OF THE MINOR PLANETS
D. R. Brooks and L. E. Cunningham (Calif. Univ., Berkeley) 27 Apr. 1974 173 p refs
(Contract NAS1-11609)
(NASA-CR-132455; LMSC-D420943) Avail: NTIS HC $11.75 CSCL 03B

The current state of minor planet ephemerides was assessed, and the means for providing and updating these emphemerides for use by both the mission planner and the astronomer were developed. A system of obtaining data for all the numbered minor planets was planned, and computer programs for its initial mechanization were developed. The computer based system furnishes the osculating elements for all of the numbered minor planets at an adopted date of October 10, 1972, and at every 400 day interval over the years of interest. It also furnishes the perturbations in the rectangular coordinates relative to the osculating elements at every 4 day interval. Another computer program was designed and developed to integrate the perturbed motion of a group of 50 minor planets simultaneously. Sampled

data resulting from the operation of the computer based systems are presented. Author

N74-32265*# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
MODEL ATMOSPHERES FOR COOL STARS
Hollis R. Johnson (Indiana Univ.) Jan. 1974 101 p refs
(Grant NGL-15-003-002)
(NASA-CR-139752; NCAR-TN/STR-95) Avail: NTIS HC $8.25 CSCL 03B

This report contains an extensive series of model atmospheres for cool stars having a wide range in chemical composition. Model atmospheres (temperature, pressure, density, etc.) are tabulated, along with emergent energy flux distributions, limb darkening, and information on convection for selected models. The models are calculated under the usual assumptions of hydrostatic equilibrium, constancy of total energy flux (including transport both by radiation and convection) and local thermodynamic equilibrium. Some molecular and atomic line opacity is accounted for as a straight mean. While cool star atmospheres are regimes of complicated physical conditions, and these atmospheres are necessarily approximate, they should be useful for a number of kinds of spectral and atmospheric analysis.
Author

N74-32266*# National Aeronautics and Space Administration, Washington, D.C.
APPENDICES FOR THE SPACE APPLICATIONS PROGRAM, 1974
May 1974 186 p refs
(NASA-TM-X-70205) Avail: NTIS HC $12.50 CSCL 22A

To achieve truly low cost system design with direct evolution for inorbit shuttle resupply, a modular building block approach has been adopted. The heart of the modular building block concept lies in the ability to use a common set of nonoptimized subsystems in such a way that a wide variety of missions can be flown with no detrimental impact on performance. By standardizing the mechanical configurations and electrical interfaces of the subsystem modules, and by designing each of them to be structurally and thermally independent entities, it is possible to cluster these building blocks or modules about an instrument system so as to adequately perform the mission without the need for subsystem redevelopments for each mission. This system concept offers the following capabilities: (1) the ability to launch and orbit the observatory by either the Delta, the Titan, or the space shuttle. (2) the ability to completely reconfigure the spacecraft subsystems for different launch vehicles, and (3) the ability to perform in-orbit resupply and/or emergency retrieval of the observatory. Author

N74-32267*# Kanner (Leo) Associates, Redwood City, Calif.
IN THE SEARCH FOR EXTRATERRESTRIAL LIFE
C. Ponnamperuma Washington NASA Aug. 1974 20 p refs Transl. into ENGLISH from Sciences (Paris), v. 12, Jan.-Feb. 1972 p 49-55
(Contract NASw-2481)
(NASA-TT-F-15856) Avail: NTIS HC $4.00 CSCL 03B

The search for extraterrestrial life is closely related to the search for the origin of life on earth. Before the biological evolution there was a chemical evolution which, in its first stages, was close to the origin of matter. All experiments which simulate primitive conditions show that life must have followed the same kind of evolution in an incalculable number of sites. There is therefore a real probability of extraterrestrial life and there is hope of contacting it if there exists a civilization far enough advanced in technology and if a proper wavelength is found.
Author

N74-32268*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
SIX-COLOR PHOTOMETRY OF IAPETUS, TITAN, RHEA, DIONE AND TETHYS
M. Noland, J. Veverka, D. Morrison (Hawaii Univ., Honolulu), D. P. Cruikshank (Hawaii Univ., Honolulu), A. R. Lazarewicz (Hawaii Univ., Honolulu), N. D. Morrison (Hawaii Univ., Honolulu), L. Elliot, J. Goguen, and J. A. Burns Apr. 1974 67 p refs
(Grants NGR-33-010-082; NGL-12-001-057)
(NASA-CR-139631; CRSR-579) Avail: NTIS HC $6.50 CSCL 03A

The extensive photometric observations of Titan, Iapetus, Rhea, Dione and Tethys have made it possible to separate the solar phase and orbital phase contributions to the observed light variations of these satellites. For Titan, the wavelength dependence of its solar phase coefficient has been obtained. This dependence should prove useful in constructing future model atmospheres. The other four satellites show a surprising array of different photometric behaviors. Despite these differences, all four satellites have similar spectral reflectivities. Clearly Iapetus, Rhea, Dione and Tethys are complex objects, varying substantially from one another in surface structure and/or composition. Author

N74-32269*# Columbia Univ., Palisades, N.Y. Astrophysics Lab.
MULTIDISCIPLINARY RESEARCH IN THE SPACE SCIENCES. SCOPE B: EXPERIMENTAL X-RAY ASTRONOMY Final Technical Report, 1 Aug. 1966 - 10 Jan. 1973
R. Novick 10 Jan. 1973 28 p refs
(Grant NGL-33-008-012)
(NASA-CR-139653; CAL-1273) Avail: NTIS HC $4.50 CSCL 03A

A research program to design and develop instruments suitable for rocket-borne X-ray astronomy experiments is discussed. Successful designs that were implemented are summarized. The designs include the following: (1) a large area modular X-ray focusing system, (2) incoherent scattering polarimeters, (3) Bragg crystal spectrometers and polarimeters, and (4) a focusing collector for long wavelength. The applications of these instruments to the observation of X-ray sources in rocket-borne experiments are analyzed. Author

N74-32270*# Kanner (Leo) Associates, Redwood City, Calif.
MARS-3: PRESSURES AND ALTITUDES BASED ON THE RESULTS OF CO2 ALTIMETRY
L. V. Ksanfomaliti, V. I. Moroz, B. S. Kunashev, and V. S. Zhegulev Washington NASA Sep. 1974 39 p refs Transl. into ENGLISH of "Mars-3: Davleniya i Vyosoty po Rezultatam CO2-Altimetri", Rept. Pr-183 USSR Acad. of Sci., Moscow, 1974 p 41
(Contract NASw-2481)
(NASA-TT-F-15910; PR-183) Avail: NTIS HC $5.00 CSCL 03B

Variations in the 2-micron CO2, band intensities were measured from the Mars-3 orbiter, giving relative pressures and altitudes. The overall range of altitude changes was close to 8 km. There is some correlation between albedo and altitude, on a scale of hundreds of kilometers: dark regions are higher (statistically) than neighboring bright ones. The upper boundary of dust clouds during the storm was 10-15 km in the equatorial region of the planet. Author

N74-32271*# Teledyne Brown Engineering, Huntsville, Ala. Research Labs.
SOLAR RADIOMETRY AT MILLIMETER WAVELENGTHS Interim Report
William Henze May 1974 30 p refs
(Contract NAS8-26442)
(NASA-CR-120426; EE-SSL-1812) Avail: NTIS HC $4.50 CSCL 03A

In the area of resolution enhancement, the use of Fast Fourier Transform programs was investigated for possible application to millimeter wavelength maps of the sun. A difficulty arises with the La Posta maps in that they are limited to 35 arc-minutes square while the smeared out solar image is larger than that. A list of possible cometary emission lines near 13 millimeters is presented. Although preparation of the list was inspired by the appearance of Comet Kohoutek, the results are applicable to any future comet. The brightness temperature of the sun at 8.6 millimeters was measured using the moon as a calibration source. The result does not confirm a deep absorption feature as apparently observed by earlier workers. Author

N74-32272# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
THE EVOLUTION OF A CONTACT BINARY
J. Hazlehurst (Sussex Univ.) and E. Meyer-Hofmeister May 1972 57 p refs
(MPI-PAE-ASTRO-51) Avail: NTIS HC $6.00

The evolution of a contact binary with a primary of 1.5 solar mass and a secondary of 1.1 solar mass is studied. It is assumed that no appreciable difference would develop between the entropies of the adiabatic portions of the convection zones of the two stars, and reasons are given for this assumption. It found that mass flows from the primary to the secondary component and it was estimated that the system would reach equal mass after about 100 million yrs. The relative frequency and other properties of the W UMa systems are discussed in the light of these results. Author (ESRO)

N74-32273# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

EVOLUTION OF CONTACT BINARIES AND STAR MODELS FOR CATACLYSMIC BINARIES

Peter Biermann and H.-C. Thomas Aug. 1972 31 p refs

(MPI-PAE-Astro-53) Avail: NTIS HC $4.75

Calculations of the evolution of contact binary systems are presented. From the observed light curve some properties of the common convective envelope can be developed. During evolution of the systems mass ratio and period increases. The observed distribution of mass ratios in the color-period diagram is in accord with the picture. In addition some models for cataclysmic binary systems, consisting of a main sequence star filling its Rochelobe and a white dwarf were calculated. The properties of these systems were discussed. Author (ESRO)

N74-32274# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

TAIL PECULIARITIES IN COMET BENNETT CAUSED BY SOLAR WIND DISTURBANCES

K. Jockers and Rh. Luest Feb. 1973 30 p refs

(MPI-PAE-Astro-56) Avail: NTIS HC $4.50

Peculiarities observed in the plasma tail of Comet Bennett between March 30 and April 7, 1970, were shown to be related to solar wind events. In particular, two series of exposures taken from stations at different geographic longitudes which show the development of a secondary tail are discussed. One of these events is clearly connected with an interplanetary shock wave. It was proposed that the ions forming the secondary tail originated in a region in front of the comet and were compressed during the shock event to a concentration dense enough to be observed. Further there seems to be correlation between kinks in the tail axis and changes of the solar wind direction. Author (ESRO)

N74-32275# Royal Aircraft Establishment, Farnborough (England).

ANALYSIS OF THE ORBIT OF COSMOS 395 ROCKET (1971-13B) NEAR 15TH-ORDER RESONANCE

A. N. Winterbottom and D. G. King-Hele Jan. 1974 26 p refs

(RAE-TR-73170; BR38576) Avail: NTIS HC $4.50

Cosmos 395 rocket (1971-13B) is moving in a near-circular orbit inclined at 74 deg to the equator. Its average height, near 540 km after launch in February 1971, slowly decreased under the action of air drag and on 24 March, 1972 it experienced exact 15th-order resonance, with the successive equator crossings 24 deg apart in longitude. Its orbit was determined at 21 epochs between September 1971 and September 1972 using 1100 observations, including 55 from the Malvern Hewitt camera: the mean sd in inclination is 0.001 deg and in eccentricity 0.00001. The variations in inclination, eccentricity, right ascension of the node, and argument of perigee near 15th-order resonance are analyzed to determine values of lumped 15th-order harmonic coefficients in the geopotential. The inclination yields equations accurate to 4% for coefficients of order 15 and degree 15, 17, 19, which are in excellent agreement with those from Cosmos 387 (1970-111A) in an orbit of similar inclination but different resonant longitude. Analysis of the variations in eccentricity gives two pairs of equations for the coefficients of order 15 and degree 16, 18 ... which are used to obtain tentative values of the (16,15) coefficients. Significant information about the geopotential was also obtained for the first time from analysis of the resonant variation of other elements, node and perigee. Author (ESRO)

N74-32276# Royal Aircraft Establishment, Farnborough (England).

MISS DISTANCE MEASUREMENT USING ONE CAMERA

A. T. Smith Dec. 1973 35 p refs

(RAE-TR-73162; BR38577) Avail: NTIS HC $4.75

Data from one high frame speed camera on a target can give missile trajectory and miss distance. A theoretical solution and indication of how it can be modified to process practical data in a computer are presented. The sources of error and their magnitudes are given. Author (ESRO)

N74-32277# Royal Aircraft Establishment, Farnborough (England).

THE EFFECTS OF 15TH ORDER RESONANCE ON THE ORBIT OF 1971-58B

H. Hiller Feb. 1974 18 p refs

(RAE-TR-73166; BR39350) Avail: NTIS HC $4.00

About 700 observations from 21 observing stations were used with the RAE computer program PROP to determine the orbit of Explorer 44 rocket (1971-58B), inclination 51.05 deg, at 17 epochs between June and November 1972; the rocket passed through exact 15th-order resonance on 20 September 1972. On three of the four runs utilizing Hewitt-camera observations, the standard deviation in inclination was near 0.0001 deg. The 17 values of orbital inclination obtained together with 17 U.S. Navy values, after the removal of significant perturbations, were fitted by a least-squares theoretical curve using the RAE computer program THROE. Values of lumped harmonic coefficients of the geopotential, of order 15 and odd degree (15,17,19,) were found. These values were used elsewhere with values from other resonant orbits at different inclinations, to calculate individual coefficients. Variations in right assension of the node and eccentricity also were analyzed. Author (ESRO)

N74-32278# Royal Aircraft Establishment, Farnborough (England).

ANALYSIS OF THE ORBIT OF COSMOS 72 (1965-53B) NEAR 15TH-ORDER RESONANCE

D. G. King-Hele and A. N. Winterbottom Feb. 1974 19 p refs

(RAE-TR-73197; BR39540) Avail: NTIS HC $4.00

Cosmos 72 (1965-53B) was launched on 16 April 1965 into a near-circular orbit with an average height of 570 km and inclination 56 deg. Over the years, the orbit has contracted slowly under the influence of air drag, and on 27 June 1972 passed through exact 15th-order resonance. The orbit was determined at seven epochs between April 1972 and February 1973, using the RAE orbit refinement program PROP, with 544 optical and radar observations: the average orbital accuracy is about 50 m in height and 0.0008 deg in inclination. For Cosmos 72 the change in inclination at 15th-order resonance, due to perturbations by 15th-order harmonics in the geopotential, is greater than for any satellite previously analysed - nearly 0.07 deg - and analysis of the change, using the seven PROP orbits and 45 U.S. Navy orbits, yields equations accurate to 4% for the geopotential coefficients of order 15 and odd degree (15, 17, 19). A similar analysis of the variation in eccentricity gives less accurate equations for coefficients of order 15 and even degree (16, 18). The variations in right assension of the node and argument of perigee were also analysed. Author (ESRO)

N74-32279# European Space Research and Technology Center, Noordwijk (Netherlands).

LONGITUDINAL-SHIFT PLAN FOR THE SCIENTIFIC GEOSTATIONARY SATELLITE GEOS

K. Knott Paris ESRO May 1974 6 p refs

(ESRO-SN-123-ESTEC) Avail: NTIS HC $4.00

An attempt is made to assemble the main arguments that were advanced for placing GEOS on a particular magnetic meridian. A short description of the scientific payload of GEOS is given. Author (ESRO)

N74-32280# Lincoln Lab., Mass. Inst. of Tech., Lexington.

TRACKING ERROR ANALYSIS FOR SATELLITE SURVEILLANCE SYSTEMS

Chester J. Kurys and William J. Steinway 29 Apr. 1974 93 p refs

(Contract F19628-73-C-0002; ARPA Order 600)

(AD-779918; TN-1974-28; ESD-TR-74-168) Avail: NTIS CSCL 22/3

The problem of determining preliminary orbit parameters of a previously unobserved satellite using several types of postulated space surveillance systems has been investigated. The space surveillance systems used in the analysis are ground-based (single-and dual-telescope systems), two ground-based radar system each with a different capability, and a satellite-borne tracking sensor. The Non-Real-Time Precision Orbit Determination (NRTPOD) Program was used as the analysis tool. The study is restricted to satellites whose perigee altitude is above 7500 km. An analysis of a typical Molniya orbit is included as a special case. The capabilities of each sensor system are studied for specific orbits. Author (GRA)

N74-32281# Naval Postgraduate School, Monterey, Calif.
A SECOND-ORDER EPSILON METHOD FOR CONSTRAINED TRAJECTORY OPTIMIZATION Ph.D. Thesis
Marle David Hewett Jun. 1974 212 p refs
(AD-780945) Avail: NTIS CSCL 16/2

A second-order epsilon method is developed for trajectory optimization problems. The method is applied to several aircraft and missile performance and air combat maneuvering problems. Heavy emphasis is placed on the realistic modeling of the flight vehicle's motion and maneuvering limitations. The proposed optimization technique, which is an extension of Balakrishnan's epsilon method, uses either the full second-order Newton-Raphson method or the modified Newton-Raphson method to minimize the epsilon functional. The full Newton-Raphson method exhibits terminal convergence characteristics superior to the modified method, whereas the modified method is generally superior in the initial stages of a problem. An algorithm is developed which uses both techniques in a complementary way. (Modified author abstract) GRA

N74-32282# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATION OF H 42 ALPHA IN ORION A Interim Report
William B. Waltman, Elizabeth B. Waltman, Philip R. Schwartz, Kenneth J. Johnston, and William J. Wilson 14 May 1974 10 p refs
(Contract F0401-73-C-0074)
(AD-779922/4; TR-0074(9230-03)-6; SAMSO-TR-74-120) Avail: NTIS HC $3.00 CSCL 03/2

The H 42 alpha (85.6884 GHz) line was observed in Orion A and found to be stronger in intensity than non-LTE theory predicts for a spherically symmetric model H 2 region. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-32283*# California Univ., Los Angeles. Mechanics and Structures Dept.
ATTITUDE CONTROL CONCEPTS FOR PRECISION-POINTING NONRIGID SPACECRAFT Final Report
Peter W. Likins Feb. 1974 101 p refs
(Contract NAS8-28358)
(NASA-CR-120320; UCLA-ENG-7413) Avail: NTIS HC $8.25 CSCL 22B

Literal criteria are developed for the controllability and observability of general models of flexible spacecraft. Results are interpreted in special cases and in physical terms, permitting in some cases the identification of uncontrollable and unobservable states simply by examination of scalars composed of modal parameters and location matrices for sensors and actuators. A procedure is established for isolation of uncontrollable states, whereby sensor and actuator configurations assure that uncontrollable flexible mode states are also unobservable; in many applications such states can then be removed by coordinate truncation. Author

N74-32284*# Singer Co., Little Falls, N.J. Kearfott Div.
ADVANCED CONTROL CONCEPTS Final Report
Maurice F. Hutton and Bernard Friedland Nov. 1973 190 p refs
(Contract NAS8-29192)
(NASA-CR-120370) Avail: NTIS HC $12.50 CSCL 22A

The selection of a trim solution that provides the space shuttle with the highest level of performance and dynamic control in the presense of wind disturbances and bias torques due to misalignment of rocket engines is described. It was determined that engine gimballing is insufficient to provide control to trim the vehicle for headwind and sidewind disturbances, and that it is necessary to use aerodynamic surfaces in conjunction with engine gimballing to achieve trim. The algebraic equations for computing the trim solution were derived from the differential equations describing the motion of the vehicle by substituting the desired trim conditions. The general problem of showing how the trim equations are derived from the equations of motion and the mathematical forms of the performance criterion is discussed in detail, along with the general equations for studying the dynamic response of the trim solution. Author

N74-32285*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
REUSABLE AGENA STUDY. VOLUME 2: TECHNICAL
W. K. Carter, J. E. Piper, D. A. Douglass, E. W. Waller, C. V. Hopkins, E. T. Fitzgerald, S. S. Sagawa, S. A. Carter, and H. L. Jensen 15 Mar. 1974 376 p refs
(Contract NAS8-29952)
(NASA-CR-120362; LMSC-D383059-Vol-2) Avail: NTIS HC $22.00 CSCL 22A

The application of the existing Agena vehicle as a reusable upper stage for the space shuttle is discussed. The primary objective of the study is to define those changes to the Agena required for it to function in the reusable mode in the 100 percent capture of the NASA-DOD mission model. This 100 percent capture is achieved without use of kick motors or stages by simply increasing the Agena propellant load by using optional strap-on-tanks. The required shuttle support equipment, launch and flight operations techniques, development program, and cost package are also defined. Author

N74-32286*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
SPACE SHUTTLE/PAYLOAD INTERFACE ANALYSIS. VOLUME 4: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 1: SUMMARY Final Report
15 Feb. 1974 14 p refs
(Contract NASw-2472)
(NASA-CR-139591; ATR-74(7334)-1-Vol-4-Pt-1) Avail: NTIS HC $4.00 CSCL 22B

Background information is provided which emphasizes the philosophy behind analytical techniques used in the business risk and value of operations in space (BRAVO) study. The focus of the summary is on the general approach, operation of the procedures, and the status of the study. For Vol. 1, see N74-12493; for Vol. 2, see N74-14530. Author

N74-32287*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
SPACE SHUTTLE/PAYLOAD INTERFACE ANALYSIS. (STUDY 2.4) VOLUME 4: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 2: USER'S MANUAL Final Report
15 Feb. 1974 263 p
(Contract NASw-2472)
(NASA-CR-139590; ATR-74(7334)-1-Vol-4-Pt-2) Avail: NTIS HC $16.25 CSCL 22B

The BRAVO User's Manual is presented which describes the BRAVO methodology in terms of step-by-step procedures, so that it may be used as a tool for a team of analysts performing cost effectiveness analyses on potential future space applications. BRAVO requires a relatively general set of input information and a relatively small expenditure of resources. For Vol. 1, see N74-12493; for Vol. 2, see N74-14530. Author

N74-32288*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.

SPACE SHUTTLE/PAYLOAD INTERFACE ANALYSIS. VOLUME 4: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 3: WORKBOOK Final Report
15 Feb. 1974 74 p
(Contract NASw-2472)
(NASA-CR-139592; ATR-74(7334)-1-Vol-4-Pt-3) Avail: NTIS HC $6.75 CSCL 22B

A collection of blank worksheets for use on each BRAVO problem to be analyzed is supplied, for the purposes of recording the inputs for the BRAVO analysis, working out the definition of mission equipment, recording inputs to the satellite synthesis computer program, estimating satellite earth station costs, costing terrestrial systems, and cost effectiveness calculations. The group of analysts working BRAVO will normally use a set of worksheets on each problem, however, the workbook pages are of sufficiently good quality that the user can duplicate them, if more worksheet blanks are required than supplied. For Vol. 1, see N74-12493; for Vol. 2, see N74-14530. Author

N74-32289*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
OPERATIONS ANALYSIS (STUDY 2.1): PAYLOAD DESIGNS FOR SPACE SERVICING
R. R. Wolfe 30 Jun. 1974 262 p refs
(Contract NASw-2575)
(NASA-CR-139588; ATR-74(7341)-3) Avail: NTIS HC $16.25 CSCL 22A

Potential modes of operating in space in the space shuttle era are documented. The October 1973 NASA Mission Model provides a definition of various NASA and non-DOD automated payload configurations when employed in an expendable mode. The model also specifies a launch schedule for initial deployment of payloads as well as for subsequent replacements at periodic cycles. This model and its associated payload definitions serve as a foundation for the data presented in this report. The reference model has been revised to reflect automated space servicing of payloads as an operational concept instead of the existing expendable approach. The indication is that the bulk of a payload's subsystems and mission equipment require no support over the lifetime of the program. However, failure of a single unit could result in loss of the mission objectives. When space servicing is employed, the approach is to replace only that unit causing the anomaly. This concept affords an opportunity to standardize space replacable units, as well as to reduce the expense of logistics support, by allowing multiple servicing on any single upper stage/shuttle flight. Author

N74-32290*# TRW Systems, Redondo Beach, Calif. Applied Mechanics Dept.
APOLLO 16, LM-11 DESCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION
A. T. Avvenire Jun. 1974 57 p refs
(Contract NAS9-12330)
(NASA-CR-134367; MSC-07230-Suppl-4; TRW-20029-H156-RO-00) Avail: NTIS HC $6.00 CSCL 22C

The performance of the LM-11 descent propulsion system during the Apollo 16 missions was evaluated and found satisfactory. The average engine effective specific impulse was 0.1 second higher than predicted, but well within the predicted one sigma uncertainty of 0.2 seconds. Several flight measurement discrepancies existed during the flight as follows: (1) the chamber pressure transducer had a noticeable drift, exhibiting a maximum error of about 1.5 psi at approximately 130 seconds after engine ignition, (2) the fuel and oxidizer interface pressure measurements appeared to be low during the entire flight, and (3) the fuel propellant quantity gaging system did not perform within expected accuracies. Author

N74-32291*# Dynatrend, Inc., Burlington, Mass.
ATMOSPHERIC ENTRY PROBES FOR OUTER PLANET EXPLORATION. OUTER PLANET ENTRY PROBE TECHNICAL SUMMARY
15 Aug. 1974 108 p refs
(Contract NAS2-7541)
(NASA-CR-137542) Avail: NTIS HC $8.50 CSCL 22A

The use of unmanned space probes for investigating the conditions existing on and around the outer planets of the solar system is discussed. The subjects included in the report are: (1) the design of a common entry probe for outer planet missions, (2) the significant trades related to the development of a common probe design, (3) the impact of bus selection on probe design, (4) the impact of probe requirements on bus modifications, and (5) the key technology elements recommended for advanced development. Drawings and illustrations of typical probes are included to show the components and systems used in the space probes. Author

N74-32292*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECT OF GRAVITATIONAL AND AERODYNAMIC TORQUES ON A RIGID SKYLAB-TYPE SATELLITE
Hans J. Sperling 1 Jun. 1974 37 p refs
(NASA-TM-X-64865) Avail: NTIS HC $3.25 CSCL 22B

A theoretical investigation of the influence of the aerodynamic torque on a Skylab-type satellite is presented. Only the case of free flow of uniform velocity and completely diffuse reflection is considered. It is found by linear stability analysis that the satellite has no stable equilibrium. Author

N74-32293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOS OBSERVATION SYSTEMS INTERCOMPARISON INVESTIGATION RESULTS
John H. Berbert Jul. 1974 45 p refs
(NASA-TM-X-70722; X-932-74-212) Avail: NTIS HC $5.25 CSCL 22A

The results of an investigation designed to determine the relative accuracy and precision of the different types of geodetic observation systems used by NASA is presented. A collocation technique was used to minimize the effects of uncertainties in the relative station locations and in the earth's gravity field model by installing accurate reference tracking systems close to the systems to be compared, and by precisely determining their relative survey. The Goddard laser and camera systems were shipped to selected sites, where they tracked the GEOS satellite simultaneously with other systems for an intercomparison observation. Author

N74-32294# TRW Systems Group, Redondo Beach, Calif. Technical Information Center.
VIKING AND THE SEARCH FOR LIFE ON MARS
Jim Schefter, ed., Donald Bane, and L. R. Magnolia, comp. [1974] 17 p refs
Avail: NTIS HC $4.00

The objectives of the Viking Mars program are explained. Previous accomplishments of the Mariner space probes are discussed. The components and sampling equipment of the Viking Lander spacecraft are described. The possibility of life on Mars and the proposed methods for determining the existence of life on Mars are examined. Author

N74-32295*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODAL TEST OF THE VIKING ORBITER
E. L. Leppert, B. K. Wada, and R. Miyakawa 15 Jul. 1974 56 p refs
(Contract NAS7-100)
(NASA-CR-139633; JPL-TM-33-688) Avail: NTIS HC $6.00 CSCL 22B

A modal test of the Orbiter Development Test Modal (ODTM) has been conducted to verify, or update, the mathematical model used for load analysis. The approach used to assure the quality and validity of the experimental data is defined, the modal test is described, and test results are presented and compared with analysis results. Good correlation between the analyses and the test data assures an acceptable model for incorporation into the mathematical model of the launch system. Author

N74-32296*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SRM INTERIM CONTRACT, PART 1 Final Report
28 Jun. 1974 149 p
(Contract NAS8-30754)
(NASA-CR-120404; TWR-10075-Pt-1; Publ-74334-Pt-1) Avail: NTIS HC $10.50 CSCL 22B

Essential studies and analyses required to integrate the SRM

into the booster and overall space shuttle system. Emphasis was placed on the case, nozzle, insulation, and propellant components with resulting performance, weight, and structural load characteristics being generated. Effort conducted during the time period of this contract included studies, analyses, planning, and preliminary design activities. Technical requirements identified in the SRM Project Request for Proposal No. 8-1-4-94-98401 and Thiokol's proposed SRM design (designated Configuration 0) established the basis for this effort. The requirements were evaluated jointly with MSFC and altered where necessary to incorporate new information that evolved after issuance of the RFP and during the course of this interim contract. Revised water impact loads and load distributions were provided based on additional model test data and analytical effort conducted by NASA subsequent to the RFP release. Launch pad peaking loads into the SRM aft skirt were provided which also represented a change from RFP requirements. A modified SRM/External Tank (ET) attachment configuration with new structural load data was supplied by NASA, and direction was received to include a 2 percent inert weight contingency. Author

N74-32297*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SRM INTERIM CONTRACT, PART 2 Final Report
28 Jun. 1974 240 p refs
(Contract NAS8-30754)
(NASA-CR-120405; TWR-10075-Pt-2; Publ-74334-Pt-2) Avail: NTIS HC $15.00 CSCL 22A

The characteristics of the solid rocket propellant for use with the space shuttle rocket engine are discussed. Design ramifications have created different web thicknesses and motor operating pressures which have necessitated small changes in the required propellant burning rate at 1,000 psia. However, the SRM burning rate remains well within the range demonstrated in the Poseidon and Minuteman first stage motors. Any change in propellant burning rate can be accomplished readily by a slight modification in the oxidizer particle size distribution. The ballistic and mechanical properties of the propellant remain unchanged from the baseline (Configuration 0). Author

N74-32298*# Linguistic Systems, Inc., Cambridge, Mass.
SOYUZ: WORKHORSE OF SPACE
G. Yelizavetin Washington NASA Aug. 1974 8 p Transl. into ENGLISH from Grazhdanskaya Aviats. (USSR), no. 4, Apr. 1974 p 22-23
(Contract NASw-2482)
(NASA-TT-F-15754) Avail: NTIS HC $4.00 CSCL 22B

During its flight of Sept. 1973, Soyuz 12 served as an astrophysical laboratory. Experiments were conducted in which spectrograms were taken of the earth's surface to locate mineral resources, and investigations of the earth's atmosphere were made. Aboard Soyuz 13, launched on Dec. 18, astrophysical observations of stars in the ultraviolet range were conducted. Tests were made on the derivation of needed protein within the life-support system of the vehicle and the circulation of the brain was measured using the Levka apparatus. Author

N74-32299*# Boeing Aerospace Co., Houston, Tex.
ASYMMETRICAL BOOSTER ASCENT GUIDANCE AND CONTROL SYSTEM DESIGN STUDY. VOLUME 1: SUMMARY Final Report
F. E. Williams, R. S. Lemon, R. F. Jaggers, and J. L. Wilson 28 Jun. 1974 83 p refs 5 Vol.
(Contract NAS9-13568)
(NASA-CR-134398; Rept-5-2581-HOU-154-Vol-1) Avail: NTIS HC $7.25 CSCL 22B

Dynamics and control, stability, and guidance analyses are summarized for the asymmetrical booster ascent guidance and control system design studies, performed in conjunction with space shuttle planning. The mathematical models developed for use in rigid body and flexible body versions of the NASA JSC space shuttle functional simulator are briefly discussed, along with information on the following: (1) space shuttle stability analysis using equations of motion for both pitch and lateral axes; (2) the computer program used to obtain stability margin; and (3) the guidance equations developed for the space shuttle powered flight phases. A.A.D.

N74-32300*# Boeing Aerospace Co., Houston, Tex.
ASYMMETRICAL BOOSTER ASCENT GUIDANCE AND CONTROL SYSTEM DESIGN STUDY. VOLUME 2: SSFS MATH MODELS - ASCENT Final Report
F. E. Williams and R. S. Lemon 28 Jun. 1974 122 p refs 5 Vol.
(Contract NAS9-13568)
(NASA-CR-134399; Rept-5-2581-HOU-154-Vol-2) Avail: NTIS HC $9.25 CSCL 22B

The engineering equations and mathematical models developed for use in the space shuttle functional simulator (SSFS) are presented, and include extensive revisions and additions to earlier documentation. Definitions of coordinate systems used by the SSFS models and coordinate tranformations are given, along with documentation of the flexible body mathematical models. The models were incorporated in the SSFS and are in the checkout stage. Author

N74-32301*# Boeing Aerospace Co., Houston, Tex.
ASYMMETRICAL BOOSTER GUIDANCE AND CONTROL SYSTEM DESIGN STUDY. VOLUME 3: SPACE SHUTTLE VEHICLE SRB ACTUATOR FAILURE STUDY Final Report
F. E. Williams and R. S. Lemon 28 Jun. 1974 134 p refs 5 Vol.
(Contract NAS9-13568)
(NASA-CR-134400; Rept-5-2581-HOU-154-Vol-3) Avail: NTIS HC $9.75 CSCL 22B

The investigation of single actuator failures on the space shuttle solid rocket booster required the analysis of both square pattern and diamond pattern actuator configurations. It was determined that for failures occuring near or prior to the region of maximum dynamic pressure, control gain adjustments can be used to achieve virtually nominal mid-boost vehicle behavior. A distinct worst case failure condition was established near staging that could significantly delay staging. It is recommended that the square pattern be retained as a viable alternative to the baseline diamond pattern because the staging transient is better controlled resulting in earlier staging. Author

N74-32302*# Boeing Aerospace Co., Houston, Tex.
ASYMMETRICAL BOOSTER ASCENT GUIDANCE AND CONTROL SYSTEM DESIGN STUDY. VOLUME 4: SAMPLED DATA STABILITY ANALYSIS PROGRAM (SADSAP) USER'S GUIDE Final Report
J. L. Wilson 28 Jun. 1974 401 p refs 5 Vol.
(Contract NAS9-13568)
(NASA-CR-140190; Rept-5-2581-HOU-154-Vol-4) Avail: NTIS HC $23.25 CSCL 22B

A users guide to the Sampled Data Stability Analysis Program (SADSAP) is provided. This program is a general purpose sampled data Stability Analysis Program capable of providing frequency response on root locus data. Author

N74-32303*# Boeing Aerospace Co., Houston, Tex.
ASYMMETRICAL BOOSTER ASCENT GUIDANCE AND CONTROL SYSTEM DESIGN STUDY. VOLUME 5: SPACE SHUTTLE POWERED EXPLICIT GUIDANCE Final Report
R. F. Jaggers 28 Jun. 1974 56 p refs 5 Vol.
(Contract NAS9-13568)
(NASA-CR-140191; Rept-5-2581-HOU-154-Vol-5) Avail: NTIS HC $6.00 CSCL 22B

An optimum powered explicit guidance algorithm capable of handling all space shuttle exoatospheric maneuvers is presented. The theoretical and practical basis for the currently baselined space shuttle powered flight guidance equations and logic is documented. Detailed flow diagrams for implementing the steering computations for all shuttle phases, including powered return to launch site (RTLS) abort, are also presented. Derivation of the powered RTLS algorithm is provided, as well as detailed flow diagrams for implementing the option. The flow diagrams and equations are compatible with the current powered flight documentation. Author

N74-32304*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 1. TECHNICAL ANALYSES AND TRADEOFFS, SECTIONS 1-4 (PART 1 OF 4) Final Study Report

29 Jul. 1973 482 p refs Prepared in part by Martin Marietta Corp., Denver, Colo.
(Contract NAS2-7249)
(NASA-CR-137504; TRW-2291-6005-RU-00) Avail: NTIS HC $27.25 CSCL 22B

The results are reported of the Pioneer Venus studies from 2 October 1972 through 30 June 1973. Many missions were considered, involving two launch vehicles (Thor/Delta and Atlas/Centaur), and different launch opportunities and spacecraft configurations to meet varying science requirements, all at minimum cost. The sequence of events is described and the specific studies conducted are summarized. The effects of science payload on mission and spacecraft design are discussed along with the mission analyses. Author

N74-32305*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 1. TECHNICAL ANALYSES AND TRADEOFFS, SECTIONS 5-6 (PART 2 OF 4) Final Study Report
29 Jul. 1973 229 p Prepared in cooperation with Martin Marietta Corp., Baltimore
(Contract NAS2-7249)
(NASA-CR-137505; TRW-2291-6006-RU-00-Vol-1-Pt-2) Avail: NTIS HC $14.50 CSCL 22B

System configuration concepts, and tradeoffs are presented for the Atlas/Centaur, and the Thor/Delta probes. Spacecraft system definition, and the probe system definition are discussed along with the mission reliability. F.O.S.

N74-32306*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 1. TECHNICAL ANALYSES AND TRADEOFFS, SECTION 7 (PART 3 OF 4) Final Study Report
29 Jul. 1973 342 p refs Prepared in cooperation with Martin Marietta, Baltimore
(Contract NAS2-7249)
(NASA-CR-137506; TRW-2291-6007-RU-00-Vol-1-Pt-3) Avail: NTIS HC $20.25 CSCL 22B

The aerodynamic design problems for the Pioneer Venus mission are discussed for a small probe shape that enters the atmosphere, and exhibits good stability for the subsonic portion of the flight. The problems discussed include: heat shield, structures and mechanisms, thermal control, decelerator, probe communication, data handling and command, and electric power. F.O.S.

N74-32307*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 1: TECHNICAL ANALYSES AND TRADEOFFS, SECTIONS 8-12 (PART 4 OF 4) Final Study Report
29 Jul. 1973 511 p refs Prepared in part by Martin Marietta Corp., Denver, Colo.
(Contract NAS2-7249)
(NASA-CR-137507; TRW-2291-6008-RU-00) Avail: NTIS HC $28.75 CSCL 22B

The probe bus and orbiter subsystems are defined, and tradeoffs analyzed. Subsystems discussed include: communications, electric power, data handling, attitude determination and control, propulsion, thermal control, structure and mechanisms, NASA/ESRO orbiter interface, mission operation, and flight support. F.O.S.

N74-32308*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. APPENDICES TO VOLUME 1, SECTIONS 3-6 (PART 1 OF 3) Final Study Report
29 Jul. 1973 143 p Prepared in cooperation with Martin Marietta Corp., Baltimore
(Contract NAS2-7249)
(NASA-CR-137508; TRW-2291-6009-RU-00-Vol-1-Pt-1) Avail: NTIS HC $10.25 CSCL 22B

The design is described of the Venus probe windows, which are required to measure solar flux, infrared flux, aureole, and cloud particles. Window heating and structural materials for the probe window assemblies are discussed along with the magnetometer. The command lists for science, power and communication requirements, telemetry sign characteristics, mission profile summary, mass properties of payloads, and failure modes are presented. F.O.S.

N74-32309*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. APPENDICES TO VOLUME 1, SECTION 7 (PART 2 OF 3) Final Study Report
29 Jul. 1973 372 p refs Prepared in part by Martin Marietta Corp., Denver, Colo.
(Contract NAS2-7249)
(NASA-CR-137509; TRW-2291-6010-RU-00) Avail: NTIS HC $21.75 CSCL 22B

The procedures for predicting the aeroheating environment of Venus entry probes are outlined. After some consideration, a number of assumptions were adopted in order to make the prediction techniques tractable. Among these assumptions are thermochemical equilibrium, uncoupled radiative and convective processes, and uncoupled ablation products effects. The single strip method of integral relations, appropriately constrained, is shown to provide adequate inviscid results as a basis for heating calculations on blunt configurations. Techniques for prediction of the laminar, transitional, and turbulent convective environment are outlined and shown to agree with data. The prediction of radiative heating in C, N, and O gas mixtures is discussed and a practical scheme adopted. A comparison with LRC calculations is made. Author

N74-32310*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. APPENDICES TO VOLUME 1, SECTIONS 8-11 (PART 3 OF 3) Final Study Report
29 Jul. 1973 265 p refs Prepared in part by Martin Marietta Corp., Denver, Colo.
(Contract NAS2-7249)
(NASA-CR-137510; TRW-2291-6011-RU-00) Avail: NTIS HC $16.25 CSCL 22B

Power subsystem cost/weight tradeoffs are discussed for the Venus probe spacecraft. The cost estimations of power subsystem units were based upon DSCS-2, DSP, and Pioneer 10 and 11 hardware design and development and manufacturing experience. Parts count and degree of modification of existing hardware were factored into the estimate of manufacturing and design and development costs. Cost data includes sufficient quantities of units to equip probe bus and orbiter versions. It was based on the orbiter complement of equipment, but the savings in fewer slices for the probe bus balance the cost of the different probe bus battery. The preferred systems for the Thor/Delta and for the Atlas/Centaur are discussed. The weights of the candidate designs were based upon slice or tray weights for functionally equivalent circuitry measured on existing hardware such as Pioneers 10 and 11, Intelsat 3, DSCS-2, or DSP programs. Battery weights were based on measured cell weight data adjusted for case weight or off-the-shelf battery weights. The solar array weight estimate was based upon recent hardware experience on DSCS-2 and DSP arrays. Author

N74-32311*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 2. PRELIMINARY PROGRAM DEVELOPMENT PLAN Final Report
29 Jul. 1973 211 p
(Contract NAS2-7249)
(NASA-CR-137511; TRW-2291-6012-RU-00) Avail: NTIS HC $13.75 CSCL 22A

The preliminary development plan for the Pioneer Venus program is presented. This preliminary plan treats only developmental aspects that would have a significant effect on program cost. These significant development areas were: master program schedule planning; test planning - both unit and system testing for probes/orbiter/ probe bus; ground support equipment; performance assurance; and science integration Various test planning options and test method techniques were evaluated in terms of achieving a low-cost program without degrading mission performance or system reliability. The approaches studied and the methodology of the selected approach are defined. Author

N74-32312*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DESIGN STUDY OF THE PIONEER VENUS SPACECRAFT. VOLUME 3. SPECIFICATIONS Final Report
29 Jul. 1973 295 p refs
(Contract NAS2-7249)
(NASA-CR-137512; TRW-2291-6013-RU-00) Avail: NTIS HC $17.75 CSCL 22A

Pioneer Venus spacecraft performance requirements are presented. The specifications include design criteria and performance requirements for the Pioneer Venus spacecraft systems and subsystems for a 1978 multiprobe mission and a 1978 orbiter mission, spacecraft system interface, and scientific instrument integration. Author

N74-32313*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
Julius J. Brecht, ed. Jan. 1974 651 p refs
(NASA-TM-X-69915; NSSDC-74-01) Avail: NTIS HC $35.75 CSCL 22B

Information dealing with active and planned spacecraft and experiments known to the National Space Science Data Center (NSSDC) is presented. Included is information concerning a wide range of disciplines: astronomy, earth sciences, meteorology, planetary sciences, aeronomy, particles and fields, solar physics, life sciences, and material sciences. These spacecraft represent the efforts and funding of individual countries, as well as cooperative arrangements among different countries. Author

N74-32314*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASSESS PROGRAM: SHUTTLE SPACELAB SIMULATION USING A LEAR JET AIRCRAFT (MISSION NO. 2)
John O. Reller, Jr., Carr B. Neel, Robert H. Mason, and C. C. Pappas Jan. 1974 116 p refs
(NASA-TM-X-62352) Avail: NTIS HC $4.50 CSCL 22B

The second shuttle Spacelab simulation mission of the ASSESS program was conducted at Ames Research Center by the Airborne Science Office (ASO) using a Lear jet aircraft based at a site remote from normal flight operations. Two experimenters and the copilot were confined to quarters on the site during the mission, departing only to do in-flight research in infrared astronomy. A total of seven flights were made in a period of 4 days. Results show that experimenters with relatively little flight experience can plan and carry out a successful research effort under isolated and physically rigorous conditions, much as would more experienced scientists. Perhaps the margin of success is not as great, but the primary goal of sustained acquisition of significant data over a 5-day period can be achieved. Author

N74-32315*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SKYLAB PROGRAM ENGINEERING AND INTEGRATION
Jul. 1974 472 p refs
(NASA-TM-X-64808) Avail: NTIS HC $9.25 CSCL 22B

A technical history and managerial critique of the MSFC role in the Skylab program is presented. The George C. Marshall Space Flight Center had primary hardware development responsibility for the Saturn Workshop Modules and many of the designated experiments in addition to the system integration responsibility for the entire Skylab Orbital Cluster. The report also includes recommendations and conclusions applicable to hardware design, test program philosophy and performance, and program management techniques with potential application to future programs. Author

N74-32316*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SKYLAB CREW SYSTEMS MISSION EVALUATION
Aug. 1974 394 p
(NASA-TM-X-64825) Avail: NTIS HC $8.25 CSCL 22B
For abstract, see N74-32315.

N74-32317*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY VIBRATION, ACOUSTIC, AND SHOCK DESIGN AND TEST CRITERIA FOR COMPONENTS ON THE SRB, ET, AND SSME
3 Sep. 1974 334 p
(NASA-TM-X-64868) Avail: NTIS HC $19.75 CSCL 22B

Design and test criteria are presented for components and subassemblies on the external tank (ET), solid rocket booster (SRB), and space shuttle main engine (SSME). Also presented are specifications for transportation, handling, and acceptance testing. The space shuttle ET, SRB, and SSME have been divided into zones and subzones. Zones are designated primarily to assist in determining the applicable specifications. A subzone (general specification) is available for use when the location of the component is known but component design and weight are not well defined. When the location, weight, and mounting configuration of the component are known, the appropriate subzone weight ranges are available. Author

N74-32318*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS TECHNOLOGY SATELLITE ATS-6 IN ORBIT CHECKOUT REPORT
W. Moore (Fairchild Industries, Inc.) and W. Prensky, ed. (Fairchild Industries, Inc.) Aug. 1974 389 p
(NASA-TM-X-70740; X-460-74-232) Avail: NTIS HC $22.50 CSCL 22C

The activities of the ATS-6 spacecraft for the checkout period of approximately four weeks beginning May 30, 1974 are described, along with the results of a performance evaluation of its subsystems and components. The following specific items are discussed: (1) subsystem requirements/specifications and in-orbit performance summary; (2) flight chronology; (3) spacecraft description; (4) structural/deployment subsystems; (5) electrical power subsystem; (6) thermal control subsystem; (7) telemetry and command subsystems; (8) attitude control subsystem; (9) spacecraft propulsion subsystem; (10) communication subsystem; and (11) experiment subsystem. A.A.D.

N74-32319*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE DEFINITION AND SPECIFICATION OF THE NEAR EARTH ENVIRONMENTAL CRITERIA FOR SPACECRAFT THERMAL DESIGN
G. A. Gary and P. D. Craven Aug. 1974 68 p refs
(NASA-TM-X-64870) Avail: NTIS HC $3.75 CSCL 22B

The variation of the earth's thermal and albedo radiation received by a near-earth orbiting space vehicle or space payload as a result of temporal variation of the earth atmosphere is discussed. A statistical study of current satellite data for determining probability distributions is proposed. With these distributions the thermal designer can define confidence levels on predicted temperature ranges which are compatible with engineering models for use in design, failure probabilities, and spacecraft cost estimates. Use of the distributions in environmental criteria guidelines is also considered. Author

N74-32320*# Chrysler Corp., New Orleans, La.
AERODYNAMIC RESULTS OF AN ABORT SEPARATION EFFECTS TEST (IA8) CONDUCTED IN THE NASA/ARC 14-FOOT TRANSONIC WIND TUNNEL ON A MODEL (6-OTS) OF THE ROCKWELL INTERNATIONAL LAUNCH CONFIGURATION INTEGRATED VEHICLE
J. H. Campbell (Rockwell International Corp.) Jun. 1974 41 p
(Contract NAS9-13247)
(NASA-CR-134107; DMS-DR-2173) Avail: NTIS HC $5.25 CSCL 22B

Experimental aerodynamic investigations were conducted on a 6-OTS 0.015-scale model. The Ames dual sting support separation rig was used to obtain grid-type data for tank-booster abort from orbiter (SSV). Freestream data were obtained for the orbiter to provide a baseline for evaluation of proximity effects. Data were obtained at Mach numbers from 0.32 to 1.1, and Reynolds number per foot varying from 2.1 million to 3.9 million. Data are not presented. Because of balance failure, a very substantial portion of the test was run with a dummy balance in the tank boosters configuration. Author

N74-32321*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC CHARACTERISTICS OF A 142-INCH DIAMETER SOLID ROCKET BOOSTER, CONFIGURATION 139 (SA2FA/SA2FB)
W. D. Radford (Northrop Services Inc., Huntsville, Ala.) and Josh D. Johnson (NASA. Marshall Space Flight Center) Jun. 1974 502 p refs
(Contract NAS9-13247)
(NASA-CR-134105; DMS-DR-2088) Avail: NTIS HC $28.25 CSCL 22B

Tests of a 2.112 percent scale model of the space shuttle solid rocket booster model were conducted in a transonic pressure tunnel. Tests were conducted at Mach numbers ranging from 0.4 to 1.2, angles of attack from minus one degree to plus 181 degrees, and Reynolds numbers from 0.6 million to 6.1 million per foot. The model configurations investigated were as follows: (1) solid rocket booster without external protuberances, (2) solid rocket booster with an electrical tunnel and a solid rocket booster/external tank thrust attachment structure, and (3) solid rocket booster with two body strakes. Author

N74-32322*# Linguistic Systems, Inc., Cambridge, Mass.
PROTOTYPE OF A SPACE HOUSE
Sergey Vlasov Washington NASA Aug. 1974 7 p Transl. into ENGLISH from Tekh. Molodezhi (USSR), no. 4, 1974 p 28-29
(Contract NASw-2482)
(NASA-TT-F-15846) Avail: NTIS HC $4.00 CSCL 22B

The Bios-3 experiment on life support in a closed-cycle environment is described. Three subjects lived in a closed-cycle environment for six months. This environment allowed 95% recycling of water and supplied 1/5 of their food. It consisted of four chambers: living quarters, chorella cultivation chamber, and two phytotrons (one for growing wheat, the other for growing vegetables: turnips, carrots, dill, cabbage, etc.). These were grown hydroponically, using xenon lamps for light. For each of the three subjects there was about 200 g of wheat and 388 g of vegetables per 24 hours. The main water source was condensation from the phytotrons and chorella cultivators. Human wastes were mineralized and partially utilized by the chorells, while waste water (from dishwashing, etc.) was utilized by the wheat and vegetables. Author

N74-32323*# Chrysler Corp., New Orleans, La. Space Div.
SUPERSONIC TESTS OF AN 0.015 SCALE SPACE SHUTTLE MATED VEHICLE MODEL (67-OTS) IN THE LaRC UPWT TO OBTAIN AERODYNAMIC FORCE DATA (IA42A/B)
R. Hardin (Rockwell Intern.) and R. Burrows (Rockwell Intern.) Jul. 1974 453 p refs
(Contract NAS9-13247)
(NASA-CR-134109; DMS-DR-2119) Avail: NTIS HC $25.75 CSCL 22B

Wind tunnel tests were conducted of the NASA/Rockwell 0.015 scale configuration 4 mated space shuttle vehicle. Data were obtained for a range of Mach numbers from 1.60 to 4.63 and angles of attack from minus 10 degrees to plus 10 degrees. A complete model build-up was performed. Longitudinal and lateral directional stability and control data were obtained for the tank alone, tank plus solid rocket boosters, and mated configuration of tank plus orbiter plus solid rocket boosters. Single component rudder hinge moment data were obtained at rudder deflections of zero degrees and minus 20 degrees for each Mach number tested. Author

N74-32324*# Chrysler Corp., New Orleans, La. Space Div.
INVESTIGATION OF SPACE SHUTTLE ORBITER SUBSONIC STABILITY AND CONTROL CHARACTERISTICS IN THE NAAL LOW SPEED WIND TUNNEL (0A62B), VOLUME 1
Robert Mennell (Rockwell Intern.) and Terrance Hughes (Rockwell Intern.) Jul. 1974 1010 p refs
(Contract NAS9-13247)
(NASA-CR-134112; DMS-DR-2104-Vol-1) Avail: NTIS HC $53.50 CSCL 22B

Experimental aerodynamic investigations were conducted on a sting-mounted 0.0405 scale representation of the 140A/B space shuttle orbiter in a 7.75 ft by 11 ft low speed wind tunnel during the time period from November 14, 1973, to December 6, 1973, with the primary test objectives being to establish basic longitudinal stability characteristics in and out of ground effect, as well as lateral-directional stability characteristics in free air. Two dual podded nacelle configurations were also tested, one with three dual podded nacelles on the lower wing surface, and the other with a single dual nacelle on the lower centerline with dual nacelle pylons mounted above each wing. Stability and control characteristics were investigated at nominal elevon, rudder, aileron, and body flap deflections. Pressure bugs were used to determine pressures on the vertical tail at spanwise stations, and aerodynamic force and moment data were measured in the stability axis system by an internally mounted, six component strain gage balance. Author

N74-32325*# Lockheed Missiles and Space Co., Huntsville, Ala.
FEASIBILITY AND TRADEOFF STUDY OF AN AEROMANEUVERING ORBIT-TO-ORBIT SHUTTLE (AMOOS) Final Report
John White Jul. 1974 279 p refs
(Contract NAS8-28586)
(NASA-CR-120431; LMSC-HREC-TR-D390272) Avail: NTIS HC $17.00 CSCL 22B

This study establishes that configurations satisfying the aeromaneuvering orbit-to-orbit shuttle (AMOOS) requirements can be designed with performance capabilities in excess of the purely propulsive space tug. In view of this improved potential of the AMOOS vehicle over the propulsive space tug concept it is recommended that the AMOOS studies be advanced to a stage comparable to those performed for the space tug. This advancement is needed in particular in areas that are either peculiar to AMOOS or not addressed in sufficient detail in these studies to date. These areas include the thermodynamics problems, navigation and guidance, operations and economics analyses, subsystems and interfaces. The aeromaneuvering orbit-to-orbit shuttle (AMOOS) is evaluated as a candidate reusable third stage to the two-stage earth-to-orbit shuttle (EOS). AMOOS has the potential for increased payload capability over the purely propulsive space tug by trading a savings in consumables for an increase in structural and thermal protection system (TPS) mass. Author

N74-32326*# Aerophysics Research Corp., Hampton, Va.
IMAGE: A COMPUTER CODE FOR GENERATING PICTURE-LIKE IMAGES OF AEROSPACE VEHICLES
C. R. Glatt Washington NASA Sep. 1974 70 p refs
(Contract NAS1-12008)
(NASA-CR-2430; LTN-11) Avail: NTIS HC $3.75 CSCL 09B

An independent geometry display program called IMAGE is presented. The use of the program permits the editing of geometric configurations and the monitoring of geometric perturbations. Author

N74-32327# Sandia Labs., Albuquerque, N.Mex.
EFFECTS OF UNSYMMETRICAL STABILITY DERIVATIVE CHARACTERISTICS ON REENTRY VEHICLE TRIM ANGLE BEHAVIOR
A. E. Hodapp, Jr. 1973 38 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974 Sponsored by AEC
(SLA-73-5635; Conf-740114-2) Avail: NTIS HC $4.00

A quasi-steady analytical theory is developed to investigate the effects that unsymmetrical stability derivative characteristics can have on the trim angle behavior of slender rolling reentry vehicles. For mass, aerodynamic and inertia asymmetries, the predicted trim angle behavior patterns are very unstable in comparison to the well-known patterns displayed by vehicles with symmetrical stability derivative characteristics. Near the resonances small asymmetries in the static moment slope characteristics are shown to cause large sometimes unbounded increases in trim magnification and jump discontinuities in windward meridian position. The analytically predicted trends are verified by six degree-of-freedom numerical simulations.
Author (NSA)

N74-32328# Sandia Labs., Albuquerque, N.Mex.
ESTIMATES FOR SHELL DEFLECTIONS OF REENTRY BODIES SUBJECTED TO LATERAL IMPULSE LOADS
M. J. Sagartz Mar. 1974 12 p refs
(Contract AT(29-1)-789)

(SLA-74-45) Avail: NTIS HC $3.00

Formulas for the deflection of elastic rings and finite cylindrical shells with simple supported and clamped boundary conditions are derived for a cosine-distributed impulse over half their circumference. These formulas provide a criterion for the gap selection in magnetically driven flyer plate tests. Author (NSA)

N74-32329# Laboratoire Central de Telecommunications, Paris (France).

UPSTREAM LINKS AT 30GHz FOR TELEVISION DISTRIBUTION SATELLITE [LIAISONS MONTANTES A 30GHz POUR SATELLITE DE DIFFUSION DE TELEVISION RAPPORT DE SYNTHESE]

[1973] 34 p In FRENCH

(ESRO-CR(P)-412) Avail: NTIS HC $4.75

The constraints are detailed, and the frequency choice is discussed with regard to atmospheric attenuation and models. The general concept of the onboard receiver is discussed with regard to technological problems, S/N ratios, mass and power budgets, reliability, and interfaces. The main characteristics of ground stations are outlined. A preliminary analysis on overall economics is presented, together with the needs in support technology. ESRO

N74-32330# Royal Aircraft Establishment, Farnborough (England).

THE PROSPERO SATELLITE ATTITUDE SENSING SYSTEM

A. K. Brookman Dec. 1972 46 p refs

(RAE-TR-73117; BR38132) Avail: NTIS HC $5.50

A system using sun slits and albedo horizon sensors to measure the attitude of a spinning satellite is described, with particular reference to the Prospero satellite. Design and construction of each type of sensor are given, and some suggestions made for future development, particularly to achieve higher accuracy. The method adopted for ground checkout of the system is described and some alternative possibilities discussed. The satellite was successfully launched on 27 October 1971. The sensor system is operating satisfactorily, but some difficulties were experienced in data reduction, due largely to the absence of a time code within the telemetry format. Preliminary results of spin axis position determinations under good conditions show a standard deviation of 0.026 deg in spin axis to sun angle and 0.23 deg in the horizon sensor component.

Author (ESRO)

N74-32331# Royal Aircraft Establishment, Farnborough (England).

THE RAE LIGHTWEIGHT SOLAR ARRAY

F. C. Treble Feb. 1974 16 p refs Presented at the Intern. Congr. on the Sun in the Service of Mankind, Paris, 2-6 Jul. 1973

(RAE-TR-73172; BR39317) Avail: NTIS HC $4.00

The development of the RAE lightweight flexible foldup solar array, culminating in the recent successful tests on a 280W prototype which have qualified the design for 6 years in geostationary orbit is presented. The array embodies a number of unique features, including 125 micrometer silicon solar cells with wraparound contacts, 100 micrometer ceria-stabilized glass coverslips, cementless mounting of cells on the flexible substrate, and deployment by a pneumatically actuated telescopic mast. A small version of the array is to be flown on the British X4 satellite in 1974. Author (ESRO)

N74-32332# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.

ACCEPTANCE AND CALIBRATION INSTRUMENTS FOR THE D2B EXPERIMENT. SYNOPSIS [BAIE DE RECETTES ET CALIBRATIONS DES EXPERIENCES D2B. SYNOPTIQUE]

Antoine Llebaria 24 Oct. 1972 35 p In FRENCH

(ELEC-016-72) Avail: NTIS HC $4.75

The acceptance and calibration test instruments required for the D-2B satellite experiments are described and the three onboard experiments briefly reviewed. The simulation consoles are detailed with regard to command and control of the experiments, working modes, characteristic cycles, sequencing, interfaces, and data formats. The optical equipment and mechanical devices are depicted with regard to light source, passive optical devices, PM tube, monochromator simulation table, and rotating table. The consoles are detailed with regard to command and control of the monochromator, data acquisition, interface control, filter wheel, PM power supply, VDU, and data processing. ESRO

N74-32333# Groupe de Recherches de Geodesie Spatiale, Paris (France).

DETERMINATION OF THE LIFETIME OF ARTIFICIAL SATELLITES IN TERRESTRIAL ORBITS [DETERMINATION DES DUREES DE VIE DE SATELLITES ARTIFICIELS EN ORBITE TERRESTRE]

Pierre Kohler Jan. 1974 55 p refs in FRENCH; ENGLISH summary

(GRGS-nt-3) Avail: NTIS HC $5.75

Satellite liftime in orbit is reviewed for optical tracking programs and orbital parameter determination. The theory of drag effect in the earth's atmosphere is discussed, and parameters of relevance to lifetime are outlined, with regard to satellite aerodynamic coefficient, sectional mass ratio, atmospheric density, differential rotation, scale height, solar influence, and other minor effects. The data are compared with average values obtained from true lifetime for several decayed objects. Nomographs for the determination of lifetime for any satellite below 600 km are given. ESRO

N74-32334# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.

KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE OBSERVING YEAR 1964 - 1965, PART 5

K. S . Russell 5 Apr. 1974 33 p ref

(ROE-STS-173) Avail: NTIS HC $4.75

Timed observations, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in satellite launch and time order for each satellite. Fully reduced observations of 28 transits of satellite are included for 1962 beta-alpha 2. Author (ESRO)

N74-32335# Royal Observatory, Edinburgh (Scotland).

STOPWATCH OBSERVATIONS OF SATELLITES. MARCH 1974

R. D. Eberst 16 Apr. 1974 26 p

(ROE-STS-175) Avail: NTIS HC $4.50

Stopwatch observations made at stations during March 1974 are listed in launch and time order for each satellite: 425 fully reduced observations of 120 satellites. Author (ESRO)

N74-32336# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.

KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE OBSERVING YEAR 1964 - 1965, PART 7

K. S. Russell 29 Apr. 1974 41 p ref

(ROE-STS-176-Pt-7) Avail: NTIS HC $5.25

Timed observations, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite: fully reduced observations of 35 transits of satellites 1963-03 A, 1963-14 A, 1963-17 A, 1963-22 A, and 1963-24 A. Author (ESRO)

N74-32337# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.

KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE OBSERVING YEAR 1964 - 1965, PART 8

K. S. Russell 30 Apr. 1974 33 p ref

(ROE-STS-177-Pt-8) Avail: NTIS HC $4.75

Timed observations, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in satellite launch and time order: fully reduced observations of 26 transits of satellites 1963-26 A and 1963-27 A. Author (ESRO)

N74-32338# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.

HEWITT CAMERA OBSERVATIONS MADE AT EARLYPOINT ON 18 MARCH 1974 FOR THE EURO-AFRICAN SHORT ARC PROJECT

R. D. Eberst 3 May 1974 11 p ref

(ROE-STS-178) Avail: NTIS HC $4.00

Satellite observations made with a Hewitt camera at Earlyburn Outstation on 18 March 1974 for the Euro-African Short Arc Project are listed in time order: 7 transits of 1966-56 A.
Author (ESRO)

N74-32339# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES. APRIL 1974
R. D. Eberst 17 May 1974 23 p
(ROE-STS-179) Avail: NTIS HC $4.25

Stopwatch observations made at stations during April 1974 are listed in launch and time order for each satellite: 398 fully reduced observations of 100 satellites. Author (ESRO)

N74-32340# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE OBSERVING YEAR 1964 - 1965, PART 10
K. S. Russell 22 May 1974 39 p ref
(ROE-STS-181-Pt-10) Avail: NTIS HC $5.00

Timed observations, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite: fully reduced observations of 31 transits of satellites 1963-43 A, 1963-49 A, 1963-49 C and 1963-53 A. Author (ESRO)

N74-32341# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE OBSERVING YEAR 1964 - 1965, PART 11
K. S. Russell 24 May 1974 34 p ref
(ROE-STS-182-Pt-11) Avail: NTIS HC $4.75

Timed observations, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite: fully reduced observations of 28 transits of satellites 1963-53 A. Author (ESRO)

N74-32342# Boston Univ., Mass. Engineering Labs.
AERODYNAMIC CHARACTERISTICS OF SOUNDING ROCKETS WITH ATTACHED GERDIAN CONDENSERS FROM MACH 2.5 TO 8
Paul Soohoo, Rocco Girolamo, and Daniel G. Vdelson Mar. 1974 67 p refs
(Contract F19628-71-C-0209; AF Proj. 7659)
(AD-780544; AFCRL-TR-73-0495) Avail: NTIS CSCL 19/7

An investigation has been conducted in the 4 in x 4 in supersonic wind tunnel at Boston University to determine the aerodynamic characteristics of a Tomahawk sounding rocket with attached gerdian condensers for a flight region of Mach 2.5 to 8. The angle of attack was varied from about -2.5 degrees to 2.5 degrees and zero sideslip was maintained. Results are presented showing the variation of the longitudinal stability with Mach number and roll angle of the condensers. No unstable configuration was found within the testing range of the present investigation. The aerodynamic forces were also determined.
Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-32343 British Library Lending Div., Boston Spa (England).
GALLOPING PHENOMENA OF OVERHEAD TRANSMISSION LINES. PART 1: THEORETICAL ANALYSIS
A. Otsuki 27 Feb. 1974 31 p Transl. into ENGLISH from Fijikura Densen Giho (Japan), no. 46, Aug. 1972 p 85-97
(BLL-CE-Trans-6310-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

A statistical mechanical theory for irregular input to distributed parameter systems in connection with the analysis of wind pressure and motion is applied to elucidate the galloping mechanism in transmission line wind problems. It is shown that self oscillations and eddy formations contribute to motion and load conditions of overhead transmission lines subjected to strong winds. G.G.

N74-32344 British Library Lending Div., Boston Spa (England).
INVESTIGATION INTO TURBINE PIPING MADE OF 12 PERCENT CHROME STEEL WHICH PREMATURELY BURST IN OPERATION
G. Darmont [1974] 15 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 70, no. 4, Apr. 1973 p 317-324
(BLL-CE-Trans-6307-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The investigations which were conducted to determine the cause of failure of a metal pipe used with a high pressure turbine engine are discussed. The examinations and tests consisted primarily of: (1) chemical composition tests, (2) metallographic examination, (3) tensile tests, and (4) short duration creep tests. The possible causes of failure were determined to be that the actual operating stresses on the pipe were higher than the working stresses adopted during design and the creep resistance of the steel was lower than that specified in the standards. Author

N74-32345*# MARC Analysis Research Corp., Providence, R.I.
WATER IMPACT ANALYSIS OF SPACE SHUTTLE SOLID ROCKET MOTOR BY THE FINITE ELEMENT METHOD Final Report
O. Buyukozturk, H. D. Hibbitt, and E. P. Sorensen Mar. 1974 90 p refs
(Contract NAS8-29195)
(NASA-CR-120319; TR73-7) Avail: NTIS HC $7.50 CSCL 20K

Preliminary analysis showed that the doubly curved triangular shell elements were too stiff for these shell structures. The doubly curved quadrilateral shell elements were found to give much improved results. A total of six load cases were analyzed in this study. The load cases were either those resulting from a static test using reaction straps to simulate the drop conditions or under assumed hydrodynamic conditions resulting from a drop test. The latter hydrodynamic conditions were obtained through an emperical fit of available data. Results obtained from a linear analysis were found to be consistent with results obtained elsewhere with NASTRAN and BOSOR. The nonlinear analysis showed that the originally assumed loads would result in failure of the shell structures. The nonlinear analysis also showed that it was useful to apply internal pressure as a stabilizing influence on collapse. A final analysis with an updated estimate of load conditions resulted in linear behavior up to full load. Author

N74-32346*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A METHOD FOR DETECTING STRUCTURAL DETERIORATION IN BRIDGES
H. A. Cole, Jr. and R. E. Reed, Jr. Jul. 1974 94 p refs
(Contract NAS2-7695)
(NASA-CR-137548; NEAR-TR-71) Avail: NTIS HC $7.75 CSCL 13B

The problem of detecting deterioration in bridge structures is studied with the use of Randomdec analysis. Randomdec signatures, derived from the ambient bridge vibrations in the acoustic range, were obtained for a girder bridge over a period of a year to show the insensitivity of the signatures to environmental changes. A laboratory study was also conducted to show the sensitivity of signatures to fatigue cracks on the order of a centimeter in length in steel beams. Author

N74-32347# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
THE USE OF WEATHER AND CLIMATOLOGICAL DATA IN EVALUATING THE DURABILITY OF BUILDING COMPONENTS AND MATERIALS Interim Report
Larry W. Masters and Winthrop C. Wolfe Aug. 1974 103 p refs Sponsored by HUD
(NBS-TN-838; LC-74-600106) Avail: SOD HC $1.45 as C13.46:838

The durability of building components and materials is dependent, to a large extent, on the in-service environment to which they are subjected in service. Thus, the prediction of

durability requires knowledge of the service environment. Weathering factors, which comprise one group of environmental factors, are the subject of this report. This report indicates how, in the present state of knowledge, weather and climate data can be used to aid in quantifying weathering factors so that durability tests for building components and materials may be designed. Author

N74-32348# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

LIFETIME CONCEPT OF PLASTER PANELS SUBJECTED TO SONIC BOOM

Barry R. Leigh Jul. 1974 78 p refs
(UTIAS-TN-191) Avail: NTIS HC $7.00

Relatively pure gypsum plaster panels were mounted in the side of the UTIAS travelling-wave sonic boom simulator in order to simulate a plaster wall subjected to sonic boom. The dynamic response of the plaster panels (16 in x 16 in x 3/8 in), subjected to sonic booms of up to 15 psf peak overpressure and of 5 ms to 1000 ms duration, was monitored by means of strain gauges attached at the centre of each panel. The maximum level of response was found to be well below that required for yield in the plaster. In order to test the Lifetime concept of plaster panels and to simulate aging effects on plaster in buildings the following tests were performed. An S/N curve was obtained by loading the plaster panels to failure at different cyclic loading levels by means of a loudspeaker-driven acoustic shaker. A number of these plaster panels were also subjected by the acoustic shaker to 10 to the 7th power loading cycles at a level slightly higher than the peak strain induced in the panels by a 10 psf, 100 ms simulated sonic boom. The prefatigued panels were then subjected to 1000 such booms. Their loading effect was judged to be more severe than booms generated by present-day SST. Author

N74-32349# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

FINITE LONGITUDINALLY MULTI-LAYERED MEMBRANE SHELLS SUBJECTED TO IMPACT LOADS

M. Ziv Sep. 1973 121 p refs
(TAE-186) Avail: NTIS HC $9.25

The transient response of a finite longitudinally multilayered cylindrical membrane shell impacted by longitudinal axisymmetric loads is obtained. Membrane stress distribution and particles' velocities are determined for the entire solution domain. The method of solution consists of characteristics finite difference technique and discontinuity relations. A characteristics finite difference integration scheme is constructed for regions where the variables are continuous. Discontinuity relations are developed to encounter the impulsive leading wave and its reflection and refraction at the interfaces. An example problem which demonstrates the method is solved. Author

N74-32350# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

THE FATIGUE STRENGTH OF JOINTS CONSIDERING THE INFLUENCE OF SECONDARY BENDING

D. Schuetz and H. Lowak 1974 80 p refs In GERMAN; ENGLISH summary
(FB-113(1974)) Avail: NTIS HC $7.00

The amount of secondary bending stresses which occurs in typical aircraft structural elements was determined using double strain gages. The influence of the secondary bending stresses on the fatigue performance of joints was investigated. The results of this investigation were completed by adding test results of the pertinent literature. A realistic value of the ratio secondary bending stress to axial stress is proposed for future fatigue testing of single shear joints. It is pointed out how the fatigue life estimation for single shear joint can be made more reliable. Author

N74-32351# Technische Universitaet, Munich (West Germany).

FORECAST OF SERVICE LIFE OF OSCILLATING, STRESSED, NOTCHED STRUCTURAL MEMBERS FROM BASIC PRINCIPLES OF FRACTURE MECHANICS Ph.D. Thesis [LEBENSDAUERVORHERSAGE SCHWINGEND BEANSPRUCHTER SCHARF GEKERBETER BAUTEILE AUF DER GRUNDLAGE DER BRUNCHMECHANIK]

Reinhard Wagner [1973] 117 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $9.00

The concept of linear-elastic fracture mechanics is applied to severely notched specimens subjected to S-N type of loading in the range of the fatigue limit. This yields that the relation between maximum stress as given by Hooke's law and number of cycles to failure is almost independent from the shape of the component and only a function of notch radius. The effect of notch radius on crack propagation and on fatigue life has been investigated on the basis of Neuber's theory of makro- and mikro-supporting effect. A procedure is presented which allows to calculate the cyclic stress-strain curve from both the S-N curves of notched and unnotched specimens. Author

N74-32352# Max-Planck-Institut fuer Eisenforschung, Duesseldorf (West Germany).

FATIGUE BEHAVIOR OF STRUCTURAL STEELS AND CRACK PROPAGATION UNDER ALTERNATING TENSION-COMPRESSION LOADING WITH CONSTANT AND VARIABLE STRESS AMPLITUDES [DAUERSCHWINGVERHALTEN VON BAUSTAEHLEN UND RISSAUSBREITUNG UNTER ZUG-DRUCK-WECHSELBEANSPRUCHUNG MIT KONSTANTEN UND VERAENDERLICHEN SPANNUNGSAMPLITUDEN]

Herman Hahn [1969] 181 p refs In GERMAN
Avail: NTIS HC $12.25

Alternating tension-compression tests with constant and variable stress amplitudes were carried out on notched specimens of St 37-3 and St 52-3 structural steels. The fatigue strength in the finite life range and the endurance limit under constant amplitude loading, the damage line, the line at which first slip bands occur, and the fatigue life curve under variable loading are plotted on one SN-diagram for comparison. The fatigue strength for the notched specimens is plus or minus 11 and plus or minus 15 kilograms per square millimeter for St-37 and St-52 specimens respectively. Author

N74-32353*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A FINITE ELEMENT ANALYSIS OF FATIGUE CRACK CLOSURE

J. C. Newman, Jr. Sep. 1974 34 p refs Presented at 8th Natl. Symp. on Fracture Mech., Providence, 26-28 Aug. 1974
(NASA-TM-X-72005; L-9715) Avail: NTIS HC $3.25 CSCL 20K

Experiments have shown that fatigue cracks close at positive loads during constant-amplitude load cycling. The crack-closure phenomenon is caused by residual plastic deformations remaining in the wake of an advancing crack tip. The present paper is concerned with the application of a two-dimensional, nonlinear, finite-element analysis for predicting crack-closure and crack-opening stresses during cyclic loading. A two-dimensional finite-element computer program, which accounts for both elastic-plastic material behavior and changing boundary conditions associated with crack extension and intermittent contact of the crack surfaces under cyclic loading, has been developed. An efficient technique to account for changing boundary conditions was also incorporated into the nonlinear analysis program. This program was subsequently used to study crack extension and crack closure under constant-amplitude and two-level block loading. The calculated crack-closure and crack-opening stresses were qualitatively consistent with experimental observations. Author

N74-32354*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.

EFFECTS OF PROOF LOADS AND COMBINED MODE LOADINGS ON FRACTURE AND FLAW GROWTH CHARACTERISTICS OF AEROSPACE ALLOYS

Ramesh C. Shah Mar. 1974 276 p refs
(Contract NAS3-14346)
(NASA-CR-134611; D180-17997-1) Avail: NTIS HC $17.00 CSCL 20K

This experimental program was undertaken to determine the effects of (1) combined tensile and bending loadings, (2) combined tensile and shear loadings, and (3) proof overloads on fracture and flaw growth characteristics of aerospace alloys. Tests were performed on four alloys: 2219-T87 aluminum, 5Al-2.5Sn

(ELI) titanium, 6Al-4V beta STA titanium and high strength 4340 steel. Tests were conducted in room air, gaseous nitrogen at -200F (144K), liquid nitrogen and liquid hydrogen. Flat center cracked and surface flawed specimens, cracked tube specimens, circumferentially notched round bar and surface flawed cylindrical specimens were tested. The three-dimensional photoelastic technique of stress freezing and slicing was used to determine stress intensity factors for surface flawed cylindrical specimens subjected to tension or torsion. Results showed that proof load/temperature histories used in the tests have a small beneficial effect or no effect on subsequent fracture strength and flaw growth rates. Author

N74-32355# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

A THREE DIMENSIONAL VARIABLE NODE ISOPARAMETRIC SOLID ELEMENT

A. Levy Jul. 1974 23 p refs

(RM-587) Avail: NTIS HC $4.25

Methods for the linear stress analysis of complex three dimensional bodies have been limited, until very recently, to a few cases involving special geometric and loading situations; corresponding analyses for nonlinear material behavior have been virtually nonexistent. With the aid of three dimensional isoparametric solid elements, many of the difficulties inherent in analyzing three dimensional nonlinear material behavior are solved. Investigations of a mixed isoparametric hexahedron containing a variable number of nodes (between 8 and 20) are presented. A derivation is shown for the element stiffness matrix, consistent mass matrix, initial strain matrix, and consistent load vector allowing for orthotropic material behavior. Various applications of the use of three dimensional isoparametric elements in elastic, elastic-plastic, composite material, and free vibration problems are included. Author

N74-32356*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLUTTER ANALYSIS OF SWEPT-WING SUBSONIC AIRCRAFT WITH PARAMETER STUDIES OF COMPOSITE WINGS

J. M. Housner and Manuel Stein Washington Sep. 1974 108 p refs

(NASA-TN-D-7539; L-9260) Avail: NTIS HC $4.50 CSCL 01C

A computer program is presented for the flutter analysis, including the effects of rigid-body roll, pitch, and plunge of swept-wing subsonic aircraft with a flexible fuselage and engines mounted on flexible pylons. The program utilizes a direct flutter solution in which the flutter determinant is derived by using finite differences, and the root locus branches of the determinant are searched for the lowest flutter speed. In addition, a preprocessing subroutine is included which evaluates the variable bending and twisting stiffness properties of the wing by using a laminated, balanced ply, filamentary composite plate theory. The program has been substantiated by comparisons with existing flutter solutions. The program has been applied to parameter studies which examine the effect of filament orientation upon the flutter behavior of wings belonging to the following three classes: wings having different angles of sweep, wings having different mass ratios, and wings having variable skin thicknesses. These studies demonstrated that the program can perform a complete parameter study in one computer run. The program is designed to detect abrupt changes in the lowest flutter speed and mode shape as the parameters are varied. Author

N74-32357# Scientific Translation Service, Ann Arbor, Mich.

INFLUENCE OF THE STATE OF STRESS ON THE RUPTURE BEHAVIOR OF METALS

H. Schiller [1974] 13 p refs Transl. into ENGLISH from Schweisstechnik (Berlin), v. 22, no. 11, 1972 p 507-511 Prepared for ORNL Sponsored by AEC

(ORNL-tr-2755) Avail: NTIS HC $3.00

In order to formulate a relation reflecting the dependence of the longitudinal fracture stress on the nature of the state of stress, it was necessary to consider various model concepts concerning the relationship between the yielding criterion, strain hardening law, and fracture behavior. It was demonstrated that a critical deformation work of the maximum tensile stress component is responsible for the occurrence of strain fractures under longitudinal rotation-symmetrical tensile stress states. This relationship could be formulated mathematically. On the basis of the formulated relation, uniaxial tensile, contraction-tensile and longitudinal compression, transverse compression tests were performed for confirmation. Materials Cl5, C35, and AlMg5 were used for the tests. The derived relationship was confirmed by the experimental studies. Author (NSA)

N74-32358# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

DYNAMIC RESPONSE BY LARGE STEP INTEGRATION

J. H. Argyris, P. C. Dunne, and T. Angelopoulos Jun. 1973 30 p refs

(ISD-144) Avail: NTIS HC $4.50

A family of unconditionally stable algorithms for the economical computation of large linear dynamic systems is described. Possible application to divergent systems is considered, and some of the difficulties of extending the use of the algorithms to nonlinear systems are discussed. In an appendix, a previously developed conditionally stable algorithm is applied to the non-linear gust response of a prestressed cable roof structure over the Munich Olympic Stadium. The idealization involves 1164 degrees of freedom. Author (ESRO)

N74-32359# Istituto der le Ricerche di Tecnologia Meccanica, Torino (Italy).

PHENOMENOLOGICAL INVESTIGATION OF THE RESONANCE EFFECTS ON THE TORSIONAL VIBRATION MODE OF A CABLE BOOM Final Report

Jun. 1973 243 p refs

(ESRO-CR(P)-414) Avail: NTIS HC $15.25

Torsional vibration resonance effects of cable booms to be used for spacecraft were studied. The test rig consisted of a mechanical driving system, heating lamps, vacuum facility, oscillating shields and glass tubes. The instruments for vacuum, temperature and speed measurement, and motion amplitude reading are described. The test program and test procedure are detailed. Test results for flat cable, ribbon cable, and square cable are given and analyzed. Laboratory and space conditions are compared and the present results are compared with BAC results. ESRO

N74-32360# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

VARIATIONAL PRINCIPLES OF ELASTOSTATICS WITH RELAXED CONTINUITY REQUIREMENTS AND THEIR APPLICABILITY TO THE FINITE ELEMENT METHOD [VARIATIONSPRINZIPIEN DER ELASTOSTATIK MIT GELOCKERTEN STETIGKEITSFORDERUNGEN UND IHRE VERWENDBARKEIT IM RAHMEN DER METHODE DER FINITEN ELEMENTE]

K. Knothe 1974 75 p refs In GERMAN

(ILR-13-1974) Avail: NTIS HC $6.75

Variational principles with relaxed continuity requirements in elastostatics are surveyed. Linear-elastic material behavior and linear geometric relations are presupposed, and only the case of static loading is dealt with. The variational principles are valid for elastic continua; these applied symbolic notation is only explained for plates. Variational principles are considered for which the following function variations occur in the field: displacement unknown (Dirichlet type), sectional forces and displacement unknown (Hellinger-Reissner type), sectional forces satisfying equilibria conditions, or stress functions unknown (Castigliano type). ESRO

N74-32361# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

RESIDUAL STRENGTH OF SANDWICH PANELS IN BENDING

G. Bartelds and A. Nederveen May 1973 11 p Sponsored by the Directorate of Materiel Air, RNLAF

(NLR-TR-73054-U) Avail: NTIS HC $4.00

A series of full depth honeycomb panels containing one cracked face sheet were tested to failure in bending. Failure was due to either crack extension in the damaged face layer or buckling of the compressive facing. The last mode occurred even when the compressed face layer was undamaged. No significant

difference in residual strength in bending towards or away from damaged facing was observed. Author (ESRO)

N74-32362# California Univ., Berkeley. Dept. of Mechanical Engineering.
RESTRICTIONS ON CONSTITUTIVE EQUATIONS OF FINITELY DEFORMED ELASTIC-PLASTIC MATERIALS
P. M. Naghdi and J. A. Trapp Apr. 1974 38 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-779855; AM-74-2) Avail: NTIS CSCL 20/12

The paper is concerned with restrictions on the constitutive equations of elastic-plastic materials in the presence of large deformation. The development is confined to the purely mechanical theory in which the response of the medium is characterized by nonlinear constitutive equations of rate-type. Starting with a physically plausible assumption concerning non-negative work in a closed cycle of deformation, the authors derive two local inequalities which hold in all motions and which place restrictions on the general constitutive equations of elastic-plastic materials. An implication of one of the inequalities is then used to express the constitutive equation for the plastic strain rate in terms of the yield (or loading) function, as well as the stress response and a measure of work hardening.
Author (GRA)

N74-32363# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
THE ENTROPE RATE ADMISSIBILITY CRITERION IN THERMOELASTICITY Interim Report
Constantine M. Dafermos May 1974 16 p refs
(Contract N00014-67-A-0191-0009; Grants DA-ARO(D)-31-124-73-G130; NSF GP-28931; NR Proj. 041-411)
(AD-779888) Avail: NTIS CSCL 20/1

The initial value problem for the dynamical equations of elasticity and thermoelasticity is not well posed in the class of smooth motions so that an existence theory in the large can be established only for thermodynamic processes with shock waves. On the other hand, in this class of processes there is no uniqueness of solutions. It is shown in the report that, by visualizing a thermoelastic material as the limit of a family of thermoviscoelastic materials of the Maxwell type, one obtains a shock admissibility criterion, the viscosity criterion. GRA

N74-32364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VIBRATIONS OF PLATES, CHAPTER 7
V. V. Bolotin and V. N. Moskalenko 22 Apr. 1974 58 p refs Transl. into ENGLISH from Prochnost i Ustoichinvost Kolebaniya (USSR), v. 3, 1968 p 370-417
(AD-780363; FTD-HC-23-1001-74) Avail: NTIS CSCL 20/11

A plate deflection equation is presented in an orthogonal system of coordinates for the dynamic circumstance. Values of basic vibrational modes for four instances of supportive reinforcement are computed by the asympotic method and Ritz's method. M.C.F.

N74-32365# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FURTHER STUDIES ON THE EFFECT OF IN-PLANE BOUNDARY CONDITIONS ON THE BUCKLING OF STIFFENED CYLINDRICAL SHELLS Interim Report
Tanchum Weller Jan. 1974 148 p refs
(Contracts F61052-69-C-0040; F44620-71-C-0116; Grant AF-AFOSR-2394-72; AF Proj. 9782)
(AD-781145; TAE-120; AFOSR-74-0965TR) Avail: NTIS CSCL 20/11

The effects of in-plane boundary conditions on the buckling loads of simply supported shells, stiffened by rings and stringers is studied. The effects differ appreciably from those in isotropic or ring stiffened shells and are considerably dependent upon stiffener geometry and location. The axial restraint, u = 0, is the predominant factor and the weak in shear, N sub x phi = 0, boundary conditions have only a minor influence. The critical loads corresponding to the SS2 and SS4 boundary conditions are appreciably raised compared to the ones obtained for the classical boundary conditions and the effect is more emphasized for internal stringers. The loads corresponding to the SS1 conditions are almost identical with the classical critical loads. (Modified author abstract) GRA

N74-32366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURAL STABILITY (CHAPTER 1 AND INTRODUCTION)
Ya. G. Panovko 3 May 1974 112 p refs Transl. into ENGLISH from Prochnost i Ustoichivost-Kolebaniya (USSR), v. 3, 1968 p 1-90
(AD-780829; FTD-HC-23-997-74) Avail: NTIS CSCL 20/11

The report considers the stability of bars, particularly elastic bars on rigid supports. GRA

N74-32367# Transport and Road Research Lab., Crowthorne (England).
WIND FORCES ON BRIDGES, DRAG AND LIFT COEFFICIENTS
J. S. Hay 1974 36 p refs
(PR-231500/0; TRRL-LR-613) Avail: NTIS HC $5.00 CSCL 13B

Drag and lift coefficients for box and plate girder bridges are derived from the results of model tests at the National Physical Laboratory. The use of these coefficients in formulating rules for calculating wind forces acting on bridges during construction and in service, to replace the wind loading clauses of BS153, is discussed. Author (GRA)

N74-32368# National Swedish Inst. for Building Research, Stockholm.
JOINTS IN SHEET METAL PANELS
Rolf Baehre and Lennart Berggren 1973 35 p refs
(PB-231493/8; ISBN-91-540-2178-2; D8:1973) Avail: NTIS HC $3.25 CSCL 13M

The report contains proposals for the design, construction, control and testing of joints in sheet metal structures. The aim of the proposals is to give the designer of sheet metal structures design information which is of a more advanced nature than the scanty material which is at present available for structural elements in the thickness range 0.5-4.0 mm. GRA

N74-32116 Joint Publications Research Service, Arlington, Va.
STATISTICAL PROPERTIES OF EMISSION FIELDS OF ELASTIC SYSTEMS
G. I. Usoskin *In its* Works of the Second All-Union School-Seminar on Statist. Hydroacoustics (JPRS-62622) 31 Jul. 1974 p 82-93 refs Transl. into ENGLISH from the book "Trudy Vtoroy Vsesoyuznoy Shkoly-Seminara po Statisticheskoy Gidroakustike" Novosibirsk, Izd. Nauka, 5 Aug. 1971 p 91-02 (For availability see N74-32111 21-23)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-32369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF EQUIVALENCE RATIO AND DWELL TIME ON EXHAUST EMISSIONS FROM AN EXPERIMENTAL PREMIXING PREVAPORIZING BURNER
David Anderson 1974 23 p refs Proposed for presentation at 20th Ann. Intern. Gas Turbine Conf., Houston, Tex., 2-6 Mar. 1975; sponsored by ASME
(NASA-TM-X-71592) Avail: NTIS HC $3.00 CSCL 21B

A flame-tube study was performed to determine the effects of equivalence ratio and residence time on exhaust emissions with premixed, prevaporized propane fuel. Nitrogen oxides emissions as low as .3 g NO2/kg fuel were measured with greater than 99% combustion efficiency at 800 K inlet temperature and an equivalence ratio of .4. For a constant combustion efficiency, lower nitrogen oxides emissions were obtained by

burning very lean with relatively long residence times than by using somewhat higher equivalence ratios with shorter times.
Author

N74-32370*# Dyna-Therm Corp., Cockeysville, Md.
DEVELOPMENT OF ELECTRICAL FEEDBACK CONTROLLED HEAT PIPES AND THE ADVANCED THERMAL CONTROL FLIGHT EXPERIMENT Technical Summary Report
Walter B. Bienert May 1974 151 p refs
(Contract NAS2-6227)
(NASA-CR-114751; DTM-74-2) Avail: NTIS HC $10.75 CSCL 20M

The development and characteristics of electrical feedback controlled heat pipes (FCHP) are discussed. An analytical model was produced to describe the performance of the FCHP under steady state and transient conditions. An advanced thermal control flight experiment was designed to demonstrate the performance of the thermal control component in a space environment. The thermal control equipment was evaluated on the ATS-F satellite to provide performance data for the components and to act as a thermal control system which can be used to provide temperature stability of spacecraft components in future applications. Author

N74-32371*# Martin Marietta Aerospace, Denver, Colo.
THERMAL RADIATION ANALYSIS SYSTEM (TRASYS) Final Report
Carl L. Jensen and Richard G. Goble Jun. 1974 59 p refs
(Contract NAS9-13033)
(NASA-CR-134391; MCR-74-100) Avail: NTIS HC $6.00 CSCL 20M

The Thermal Radiation Analysis System, TRASYS, is a digital computer software system with generalized capability to solve the radiation-related aspects of thermal analysis problems. When used in conjunction with a generalized thermal analyzer program any thermal problem that can be expressed in terms of a lumped parameter R-C thermal network can be solved. The function of TRASYS is twofold. It provides: (1) internode radiation interchange data; and (2) incident and absorbed heat rate data from environmental radiant heat sources. Data of both types is provided in a format directly usable by the thermal analyzer programs. One of the primary features of TRASYS is that it allows the user to write his own executive or driver program which organizes and directs the program library routines toward solution of each specific problem in the most expeditious manner. The user also may write his own output routines, thus the system data output can directly interface with any thermal analyzer using the R-C network concept. Author

N74-32372*# Tulsa Univ., Okla. Dept. of Mechanical Engineering.
ENERGY TRANSFER IN VOLUME-REFLECTING HEAT SHIELDS Final Technical Report, Jan. 1972 - Aug. 1974
Kenneth C. Weston Aug. 1974 75 p refs
(Grant NGR-37-008-003)
(NASA-CR-139659) Avail: NTIS HC $6.75 CSCL 20M

An approximate analysis of radiative transfer in highly scattering materials was developed based on the Kubelka-Munk differential equations--a set of two differential equations representing the spatial rate of change of radiative half-fluxes within the scattering media. These approximate solutions of the Kubelka-Munk equations together with analytic solutions for the steady state temperature distribution for two types of boundary conditions are given. These solutions show the influence of back surface reflectance, scattering power, incident radiative flux parameter and boundary conductive flux parameter on overall reflectance and temperature distributions. This radiation field analysis, adapted to spherical geometry, was applied to the evaluation of the thermal performance of teflon and fritted quartz as heat protection materials for entry into the atmosphere of Jupiter. Author

N74-32373*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF IMPINGEMENT HEAT TRANSFER FOR TWO PARALLEL LIQUID-METAL SLOT JETS
Robert Siegel Washington Sep. 1974 40 p refs
(NASA-TN-D-7772; E-7906) Avail: NTIS HC $3.25 CSCL 20M

An analytical method is developed for determining heat transfer by impinging liquid-metal slot jets. The method involves mapping the jet flow region, which is bounded by free streamlines, into a potential plane where it becomes a uniform flow in a channel of constant width. The energy equation is transformed into potential plane coordinates and is solved in the channel flow region. Conformal mapping is then used to transform the solution back into the physical plane and obtain the desired heat-transfer characteristics. The analysis given here determines the heat-transfer characteristics for two parallel liquid-metal slot jets impinging normally against a uniformly heated flat plate. The liquid-metal assumptions are made that the jets are inviscid and that molecular conduction is dominating heat diffusion. Wall temperature distributions along the heated plate are obtained as a function of spacing between the jets and the jet Peclet number. Author

N74-32374*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATION OF THE IGNITION AND COMBUSTION OF A HYDROGEN JET IN AIR AT FINITE CHEMICAL-REACTION RATES
V. K. Bayev, V. I. Golovichev, V. I. Dimitrov, and V. A. Yasakov Washington NASA Aug. 1974 21 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 10, Jan. - Feb. 1974 p 65-74
(Contract NASw-2483)
(NASA-TT-F-15884) Avail: NTIS HC $4.25 CSCL 20M

Analytical and experimental study of the turbulent mixing of a central hydrogen jet in an associated air flow heated by combustion. To determine the local values of the averaged flowfield parameters, a computational model was developed which includes a numerical solution of the conservation equations for the boundary layer, written in terms of Mises variables. The model uses an empirical description of turbulent transport and values of the reaction rate constants for which it is assumed that the Arrhenius form of the temperature dependence is valid. An experimental study was carried out for a qualitative comparison of the experimental data with predictions of the computational model. It is shown both experimentally and numerically that the location of the apparent flame boundary is significantly affected by the kinetic prehistory of the mixing flows. Author

N74-32375# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
MEASUREMENTS OF A SIMULATED ROCKET EXHAUST PLUME NEAR THE PRANDTL-MEYER LIMITING ANGLE
Vincent S. Calia and John W. Brook Aug. 1974 25 p refs
(RE-482) Avail: NTIS HC $4.25

Direct measurements of the mass flux level and estimates of the mass velocity have been made in the side flow field of a small axisymmetric rocket nozzle operated in hard vacuum. A shock tube provided nitrogen and simulated rocket propellant (nitrogen tetroxide and Aerozene 50) sources for the nozzle. Data were recorded in the plume far field, for angles ranging from 0 to 90 deg relative to the nozzle centerline. In all cases, substantial mass flux levels were observed in the neighborhood of the limiting Prandtl-Meyer characteristic. At an angle of 90 deg to the nozzle centerline, the density levels were typically three orders of magnitude below centerline values and the mass velocities were approximately one-half of the centerline values. In the inviscid core flow, the measurements compare favorably with method of characteristics predictions of the inviscid flow field. Author

N74-32376# Pennsylvania State Univ., University Park.
THERMODYNAMIC PROPERTIES OF SOLID SOLUTIONS AT HIGH TEMPERATURES
A. Muan 1973 10 p refs
(Contract AT(11-1)-3410)
(COO-3410-2) Avail: NTIS HC $3.00

The research was concerned with the determination of thermodynamic properties of inorganic materials at high temperatures. Experimental methods were developed which permit accurate and reliable determination of activity-composition relations in solid solutions, and stabilities of end-member compounds. The data provide insight into the general laws governing the behavior of materials in high-temperature environments. The phases selected for the experimental studies include

orthosilicates, metasilicates, oxides of periclase structure, spinels, and titanates. It has been shown that directions of conjugation lines between coexisting solid-solution phases provide a powerful tool for determining relative stabilities of end-member compounds and activity-composition relations of solid solutions. In general, oxide phases (including silicates and titanates) forming complete solid-solution series at high temperatures show less deviations from ideality in their activity-composition relations than do alloy systems. Deviations from ideality are particularly small for many solid solutions of relatively simple structures (e.g. oxides of periclase structure), whereas those of greater structural complexities (e.g. spinels) show larger deviations from ideality.
Author (NSA)

N74-32377# California Univ., Livermore. Lawrence Livermore Lab.
DISPERSION OF SST EXHAUST PLUMES IN THE STRATOSPHERE
J. J. Walton 11 Jan. 1974 22 p refs Conf. presented at 1st Spec. Assembly of the Intern. Assoc. of Meterology and Atmospheric Physics, Melbourne, Australia, 14-25 Jan. 1974
(Contract W-7405-eng-48)
(UCRL-74886) Avail: NTIS HC $3.25

Certain characteristics of multi-dimensional coupled kinetics-transport codes preclude exploration of a wide range of the characteristics processes in the atmosphere. For this reason a parameterization of transport effects has been obtained for use in conjunction with a single box kinetics program developed at LLL. Using this coupled model a study of the sensitivity of O3 destruction to transport and source parameters has been carried out to serve as a guide to specific problems of interest for study by the available multi-dimensional codes. Author (NSA)

N74-32378# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF THE PROPERTIES OF GAS FUEL ON THE OPERATION OF JET STABILIZER BURNERS
V. A. Khristich and G. N. Lyubchik 30 Apr. 1974 16 p refs Transl. into ENGLISH from Teor. Prakt. Szhiganiya Gaza (USSR), v. 5, 1972 p 125-132
(AD-780409; FTD-HT-23-877-74) Avail: NTIS CSCL 21/2

The article is devoted to studying the effect of the type of fuel used on the basic rules of operation of jet-stabilizer burners. The main studies were conducted on methane, hydrogen and propane. GRA

N74-32379# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF ACOUSTIC VIBRATIONS ON TURBULENT BOUNDED FLAME
Yu. Ya. Borisov, E. I. Rozenfeld, and V. G. Smolenskii 23 Apr. 1974 19 p refs Transl. into ENGLISH from Teor. Prakt. Szhigeniya Gaza (USSR), no. 5, 1972 p 42-53
(AD-779813; FTD-HT-23-868-74) Avail: NTIS CSCL 21/2

Acoustic vibrations or vibrations from a mechanical turbulizer imposed on a flame enables intensification of the gas combustion processes and regulation of the characteristics of the flame. However, at the present time there is no unified approach to the treatment of the physical principles of the effect of an acoustical field on a turbulent flame, and this can be explained basically by the limited amount of experimental data. The purpose of this article is to study the effect of acoustic vibrations on a bounded turbulent flame by analyzing concentration, temperature, velocity, and acoustic fields and the characteristics of turbulence within the volume of the furnace chamber. Studies were made under conditions close to the combustion of natural gas in industrial heat assemblies. GRA

N74-32380# Harry Diamond Labs., Washington, D.C.
POWER SUPPLIES FOR ORDNANCE FUZING
Asaf A. Benderly Feb. 1974 17 p
(HDL Proj. 902494; DA Proj. 1T1-62119-A-002)
(AD-780028; HDL-TM-74-2) Avail: NTIS CSCL 19/1

The report describes the types of power supplies considered for ordnance fuzing, their capabilities, the state-of-the-art, and the recommended approaches for these fuzing applications, based on a recent consensus by the fuze power-supply community. GRA

N74-32381# Westinghouse Research Labs., Pittsburgh, Pa.
EVALUATION OF THE FLUIDIZED-BED COMBUSTION PROCESS. VOLUME 1: PRESSURIZED-BED COMBUSTION PROCESS DEVELOPMENT AND EVALUATION Final Report, Jul. 1971 - May 1973
D. L. Keairns, D. H. Archer, J. R. Hamm, R. A. Newby, and E. P. ONeill Dec. 1973 365 p refs
(Contract EPA-68-02-0217)
(PB-231162/9; EPA-650/2-73-048A) Avail: NTIS HC $8.00 CSCL 13B

The report presents: results of a process evaluation of the pressurized fluidized-bed combustion (FBC) system for power generation; preliminary plans and a cost estimate for a 30-MW pressurized FBC boiler development plant; identification of a project team and program to demonstrate FB oil gasification/desulfurization for power generation on a 50-MW plant; and evaluation of pressurized oil gasification for combined-cycle power generation. It identifies no problems which preclude the development of pressurized FBC combined-cycle power plants and FB oil gasification power plants which can generate electrical energy within environmental goals at lower energy costs than competitive systems. Work reported here, a continuation of earlier FBC process evaluation efforts, is aimed at the development and demonstration of these fuel processing systems. GRA

N74-32382# Westinghouse Research Labs., Pittsburgh, Pa.
EVALUATION OF THE FLUIDIZED-BED COMBUSTION PROCESS. VOLUME 2: FLUIDIZED-BED BOILER COMBINED CYCLE POWER PLANT DEVELOPMENT. VOLUME 1: APPENDICES Final Report
D. L. Keairns, D. H. Archer, J. R. Hamm, R. A. Newby, and E. P. ONeill Dec. 1973 245 p refs
(Contract EPA-68-02-217)
(PB-231163/7; EPA-650/2-73-048A-D) Avail: NTIS HC $6.00 CSCL 13B

Contents cover the following: (1) economic sensitivity; (2) sulfur removal systems; (3) plant operation and control; and (4) alternative fluid bed boiler concepts. GRA

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Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-32383 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES Interim Report
Jul. 1973 60 p refs
Copyright. Avail: Issuing Activity

A study and analysis of possible emergency supplements to or alternatives for imported oil, natural gas liquids, and petroleum products in the event of an interruption of these imports. The areas of the study which are significant include evaluations of savings through petroleum use curtailment which might be realized through voluntary and mandatory measures, estimates of emergency oil production volumes, and evaluations of the feasibility and cost of providing emergency standby petroleum supplies by storage or by restriction of domestic production. The various conditions to be met by the energy crisis and the policies to be followed are analyzed. Author

N74-32384 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES. A SUPPLEMENTAL INTERIM REPORT OF THE NATIONAL PETROLEUM COUNCIL
15 Nov. 1973 63 p
Copyright. Avail: Issuing Activity

A study was conducted to assist government and industry in efforts to alleviate the effect of energy interruption and to cope with the current energy crisis. A history of the factors leading to the energy crisis is provided as background data.

Tables of data are provided to show the demand and availability of various energy sources. It is stated that the U.S. must develop an energy self-sufficiency which will not allow the Nation to be vulnerable to an imports interruption. Domestic energy resources are more than adequate to meet this goal, but a national program must be initiated to develop them. Only through a coherent and cohesive National Energy Policy can the U.S. avoid a repetition of the inconvenience and hardship caused by the fuel embargo.
Author

N74-32385 National Petroleum Council, Washington, D.C.
EMERGENCY PREPAREDNESS FOR INTERRUPTION OF PETROLEUM IMPORTS INTO THE UNITED STATES. SUPPLEMENTAL PAPERS TO INTERIM REPORT OF 15 NOVEMBER 1973
21 Dec. 1973 141 p refs
Copyright. Avail: Issuing Activity

A study was conducted to analyze the impact of the energy shortages and to determine steps to be taken to alleviate the effects on the U.S. economy. The subjects considered include the following: (1) crude oil supply and transportation, (2) emergency oil and gas production, (3) fuel convertibility and alternate energy sources, and (4) energy use curtailment. Tables of data are provided to show resource availability and future production capabilities for selected energy sources. Author

N74-32386*# Evaluation Technologies, Inc., Arlington, Va.
THE DESIGN, DEVELOPMENT, AND PRESENTATION OF A PILOT SEMINAR CALLED TECHNOLOGY AND OPPORTUNITY: A NEW APPROACH FOR MINORITY BUSINESS Final Report
24 Jun. 1974 168 p
(Contract NASw-2642)
(NASA-CR-139641) Avail: NTIS HC $11.50 CSCL 05C

A seminar program is reported that furthers the transfer of NASA technology to the minority community and assists in the commercial development of marketable products and manufacturing capabilities. G.G.

N74-32387# Patent Office, Washington, D.C.
TECHNOLOGY ASSESSMENT AND FORECAST, THIRD REPORT, JUNE 1974
Jun. 1974 181 p refs
Avail: NTIS HC $12.25

Profiles of activity within selected, active technological areas, both in the U.S. and in foreign countries, is presented for the purpose of providing an assessment overview and forecast of current technology. Energy technology is discussed with a focus on the broad topic of obtaining liquid hydrocarbons or gaseous hydrocarbons from solid carbonaceous material. The principal processes described are those involving coal gasification, and the obtaining of oil from shale. An overview of technological activity, for all countries combined, for the U.S. alone, for all foreign countries combined, and for certain selected countries, is presented according to quantitative contribution and amount of effort in 258 broad categories of technology, as measured by patents. Similar profiles are provided for six states. Specific reports are included for the categories of optics and photography, electronics, stock materials, coating, bonding, and molding, and chemical compositions and processes. A.A.D.

N74-32388# Commerce Dept., Washington, D.C.
TECHNOLOGY ASSESSMENT AND FORECAST: EARLY WARNING REPORT OF THE OFFICE OF TECHNOLOGY ASSESSMENT AND FORECAST, DECEMBER 1973
Dec. 1973 282 p
Avail: NTIS HC $17.25

Information designed to assist business, government, and the academic community in decision making situations is presented according to overall and foreign activity in active technological areas. Reports on specific areas include the following categories: (1) optics; (2) photography; (3) electronics; (4) stock materials; (5) metallurgy and metalworking; (6) coating, bonding, and molding; (7) high polymer chemistry and chemical compositions; (8) textile manufacturing; (9) vehicles. A comprehensive state-of-the-art and forecast analysis is also given for emerging energy sources. Research activity in nuclear energy is described, and data is presented for ongoing development of natural energy resources, including solar energy, geothermal energy, and tide and wave energy. A.A.D.

N74-32389# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
INDEX OF INTERNATIONAL STANDARDS
Sophie J. Chumas Mar. 1974 222 p refs
(NBS-SP-390) Avail: SOD HC $5.60 as C13.10:390

The computer produced index, based on the Key-Word-In-Context (KWIC) system, contains over 2,700 standard titles of the Internation Organization for Standardization, the Internation Electrotechnical Commission, the International Commission on Rules for the Approval of Electrical Equipment, the International Special Committee on Radio Interference, and the International Organization of Legal Metrology. Author

N74-32390# Joint Committee on Defense Production (U. S. Congress).
ACTIVITIES OF THE JOINT COMMITTEE ON DEFENSE PRODUCTION WITH MATERIAL ON MOBILIZATION FROM DEPARTMENTS AND AGENCIES, PART 1 Twenty-Third Annual Report of the Joint Comm. on Defense Production to the Congress of the United States
John Sparkman Washington GPO 7 Feb. 1974 588 p refs
Presented to the 93d Congr. of the United States, 2d Sess., 5 Feb. 1974
(S-93-683; GPO-23-827) Avail: US Capitol, Senate Document Room

The text of a report to Congress is presented which fulfills the responsibility of the Joint Committee on Defense Production to make a continuous study of the programs authorized by the Defense Production Act, and to review the progress achieved in the execution and administration of these programs, including preparedness measures for future emergencies. Department reports are provided by USDA, DOC, DOD, HEW, HUD, DOI, the Department of Justice, and the Department of Labor. Each individual report outlines current work and future objectives, along with appraisals of resources, funds, and organizational management. A comprehensive report by the Office of Emergency Preparedness includes an assessment of role and readiness of the Federal Government, state and local obligations, crisis management, industrial mobilization planning, and support functions. The formal report of the Joint Committee discusses the following: (1) energy contained in stockpile of materials; (2) energy resources and oil priority; (3) proposed sale of materials; (4) priorities and allocations such as aluminum, copper, steel, and nickel set-asides; (5) estimated future cash requirements, (6) upgrading of strategic and critical materials; (7) guaranteed loans; (8) small business; and (9) military contract awards. A.A.D.

N74-32391# Joint Economic Committee (U. S. Congress).
A REAPPRAISAL OF US ENERGY POLICY
William Proxmire, Henry S. Reuss, and Hubert H. Humphrey Washington GPO 8 Mar. 1974 50 p refs Rept. of the Subcomm. on Consumer Economics, Subcomm. on Intern. Economics, and Subcomm. on Priorities and Economy in Govt., 93d Congr., 2d Sess., 8 Mar. 1974
(GPO-29-215) Avail: SOD HC $0.60

Brief summaries of twenty recommendations are reported to Congress in preface to a reappraisal of U.S. energy policy, which includes an assessment of the current fuel situation and the effects of policies designed to curb the shortages. Price controls and gasoline rationing are discussed with consideration of mandatory allocation of a more diverse range of oil products. Measures to curb consumption over the long run are also discussed in terms of transportation savings, lowered heating requirements, and reduced consumer demand for gas and electricity. Several alternatives are presented for stimulating domestic oil production, and the international oil situation is discussed in terms of its effects on the separate interests of producers and consumers. A.A.D.

N74-32392# Joint Economic Committee (U. S. Congress).
THE 1975 BUDGET: AN ADVANCE LOOK
Richard Kaufman, Douglas Lee, Courtney Slater, and Nancy Teeters Washington GPO 27 Dec. 1973 37 p refs A staff study presented to the Subcomm. on Priorities and Economy in

Govt., 93d Congr., 1st Sess., 20 Dec. 1973
(GPO-26-216) Avail: SOD HC $0.40

A study was conducted to provide members of Congress and Congressional Committees with information concerning the formation of the 1975 budget. The study was assembled from public sources and defines certain policy options with respect to the 1975 budget is outlined as a basis of decision. The expenditure baseline for 1975 is developed. The subjects discussed include the following: (1) budget receipts and the economic impact of the 1975 budget, (2) tax changes and program cuts as sources of additional funds, (3) new program initiatives, and (4) energy-related taxes and expenditures. Author

N74-32393# Joint Economic Committee (U. S. Congress).
NATIONAL PRIORITIES AND THE BUDGETARY PROCESS
Washington GPO 1974 159 p refs Hearings before Subcomm. on Priorities and Economy in Govt., 93d Congr., 1st Sess., 25, 26, 27 Apr. 1973
(GPO-96-679) Avail: SOD HC $1.40

Congressional hearings on the budgetary aspects of the Fiscal 1975 Federal Budget were conducted. The purposes of the budgetary hearings are defined as: (1) communicating to the administration information about Congress' attitudes toward the shape and size of the budget for the year ahead, (2) focusing public opinion at an early date on the issues that will be taised by the President's budget, and (3) reinforcing the discipline on the Congress to think ahead in making current choices. The hearings consisted primarily of testimony from selected witnesses and members of the committee. P.N.F.

N74-32394# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1975. PART 4: INDEX
Washington GPO 1974 136 p Hearings on S. 2955 before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 1974
(GPO-36-527) Avail: Comm. on Aeronaut. and Space Sci.

Congressional hearings on the authorization of appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management are presented. Financial requirements of the various NASA programs are defined and the data to support the requirements are provided by selected witnesses. P.N.F.

N74-32395# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1975, PARTS 1, 2, 3, AND 4 OF INDEX
Washington GPO 1974 648 p Index for hearings on H.R. 12689 before Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 1974 H.R. 12689 (superseded by H.R. 13998)
(GPO-38-444) Avail: Comm. on Sci. and Astronaut.

An index of the names of persons and places involved in the NASA authorization for fiscal year 1975 is presented. The index is used in conjunction with parts 1, 2, 3, and 4 of the proceedings of the House of Representatives. P.N.F.

N74-32396# Committee on Science and Astronautics (U. S. House).
REPORT ON THE INTERNATIONAL CONFERENCE OF STATES ON THE DISTRIBUTION OF PROGRAMME-CARRYING SIGNALS TRANSMITTED BY SATELLITE IN BRUSSELS, BELGIUM, 6-21 MAY 1974
Washington GPO Jul. 1974 48 p refs Rept. presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., Jul. 1974
(GPO-37-404) Avail: Comm. on Sci. and Astronaut.

The proceedings of a conference to discuss the problems arising from unauthorized use and transmission of signals received from communications satellites are reported. The measures to be supported by the member nations in dealing with the problem are stated in twelve articles. The principle measure adopted by the conference is that each member nation will undertake adequate measures to prevent the distribution on or from its territory of any program-carrying signal by any distributor for whom the signal emitted to or passing through the satellite is not intended. Author

N74-32397*# National Aeronautics and Space Administration, Washington, D.C.
REVIEW OF THE SPACE APPLICATIONS PROGRAM, 1974
May 1974 326 p refs
(NASA-TM-X-70211) Avail: NTIS HC $19.50 CSCL 22A

The purpose of this review is to provide the participants in the National Aeronautics and Space Administration/National Academy of Engineers' Summer Study in Applications a concise overview of the NASA Applications Program as it stands in 1974. The review covers the accomplishments of the various discipline-oriented programs that make up the total Applications Program, discusses the program plan for the 1975 to 1980 period, and examines the anticipated spaceflight capabilities of the 1980's. NASA has requested the National Academy of Engineers to conduct through its Space Applications Board a comprehensive study of the future Space Applications Program encompassing the following: (1) the Applications Program in general, with particular emphasis on practical approaches, including assessment of the socio-economic benefits and (2) how the broad comprehensive program envisioned above influences, or is influenced by, the shuttle system, the principal space transport system of the 1980's. Author

N74-32398# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL PROGRAM, 1975
Jul. 1974 34 p
(AGARD-Bul-74-2) Avail: NTIS HC $4.75

The program that was approved by the AGARD National Delegates Board is reported. Section 1 includes a chronological listing of the meetings tentatively scheduled to take place during 1975 and Section 2 portrays a detailed description of the individual panel programs, the consultant and exchange program, and the military committee studies program. The total budget required to support the proposed 1975 AGARD technical program is presented. Author

N74-32399# Advisory Group for Aerospace Research and Development, Paris (France).
A GUIDE TO THE LAYOUT OF TECHNICAL PUBLICATIONS
A. H. Holloway Jun. 1974 22 p refs
(AGARD-AG-178; AGARDograph-178) Avail: NTIS HC $4.25

Recommendations are made for the size, shape, layout and content of technical publications. Notes are included to help those responsible for writing, reproducing and handling these documents. A select bibliography and some notes for cataloguers are included. Relevant standards are listed in an appendix with some further notes on bibliographic references. Author

N74-32400*# TRW Systems, Houston, Tex.
SPACE SHUTTLE PROGRAM: SHUTTLE AVIONICS INTEGRATION LABORATORY. VOLUME 7: LOGISTICS MANAGEMENT PLAN
1974 17 p refs 9 Vol.
(Contract NAS9-13834)
(NASA-CR-134363; JSC-08663-Vol-7) Avail: NTIS HC $4.00 CSCL 05A

The logistics management plan for the shuttle avionics integration laboratory defines the organization, disciplines, and methodology for managing and controlling logistics support. Those elements requiring management include maintainability and reliability, maintenance planning, support and test equipment, supply support, transportation and handling, technical data, facilities, personnel and training, funding, and management data. Author

N74-32401*# Alabama Univ., Huntsville.
THE SATURN MANAGEMENT CONCEPT
Roger E. Bilstein 1 Jun. 1974 76 p refs
(Grant NGT-01-002-080)
(NASA-CR-129029) Avail: NTIS HC $4.00 CSCL 05A

Management of the Saturn launch vehicles was an evolutionary process, requiring constant interaction between NASA Headquarters, the Marshall Space Flight Center (particularly the Saturn 5 Program Office), and the various prime contractors. Successful Saturn management was a blend of the decades of

experience of the von Braun team, management concepts from the Army, Navy, Air Force, and Government, and private industry. The Saturn 5 Program Office shared a unique relationship with the Apollo Program Office at NASA Headquarters. Much of the success of the Saturn 5 Program Office was based on its painstaking attention to detail, emphasis on individual responsibilities (backed up by comprehensive program element plans and management matrices), and a high degree of visibility as embodied in the Program Control Center. Author

N74-32402*# Scientific Translation Service, Santa Barbara, Calif.
LEGAL PROBLEMS OF THE CONQUEST OF THE MOON AND PLANETS
E. G. Vasilevskaya Washington NASA Aug. 1974 136 p refs Transl. into ENGLISH of the book "Pravovye Problemy Osvoyeniya Luny i Planet" Moscow, Nauka Press, 1974 129 p
(Contract NASw-2483)
(NASA-TT-F-15756) Avail: NTIS HC $10.00 CSCL 05D

On the basis of an analysis of such international documents as the Treaty on Outer Space of 1967, the Agreement on Cosmonaut Safety of 1968, etc., this book discusses legal problems arising in connection with the active conquest of the moon and planets. The concept of celestial body is clarified, and several foreign concepts justifying aggressive trends in relation to the moon are critically discussed. Along with analysis of the most important documents determining bases for legal regulation of activity on the moon and planets, the draft of an international lunar treaty, submitted by the U.S.S.R. to the UN for consideration in June, 1971, is analyzed in detail. Author

N74-32403# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1975. PART 1: PAGES 1-821
Washington GPO 1974 850 p refs Hearings on H.R. 15572 before Subcomm. of the Comm. on Appropriations, 93d Congr., 2d Sess., 11 Jan. 1974
(GPO-27-909) Avail: Comm. on Appropriations

A Congressional hearing was conducted to inform the Committee on Appropriations Subcommittee of the rationale behind the NASA budget request for fiscal year 1975, with testimony focusing upon NASA project plans and operating budget, and in particular, on the status of NASA's equal opportunity programs, especially in relation to the dismissal of Mrs. Ruth Bates Harris, the Deputy Director of the NASA Equal Opportunity Office. Full budget summaries are provided with breakdowns by office, installation, and project. Space shuttle is emphasized as a program requiring special attention by the Committee. Other budget hearings included in the report are for the following agencies and boards: (1) Selective Service System; (2) Federal Home Loan Bank Board; (3) Veterans Administration; and (4) the Renegotiation Board. A.A.D.

N74-32404*# Grumman Aerospace Corp., Bethpage, N.Y.
OPERATIONS PLANNING SIMULATION: MODEL STUDY Final Report
23 May 1974 161 p
(Contract NAS8-30302)
(NASA-CR-120429; SU-OPS-RP-74-0001) Avail: NTIS HC $11.25 CSCL 05A

The use of simulation modeling for the identification of system sensitivities to internal and external forces and variables is discussed. The technique provides a means of exploring alternate system procedures and processes, so that these alternatives may be considered on a mutually comparative basis permitting the selection of a mode or modes of operation which have potential advantages to the system user and the operator. These advantages are measurements is system efficiency are: (1) the ability to meet specific schedules for operations, mission or mission readiness requirements or performance standards and (2) to accomplish the objectives within cost effective limits. Author

N74-32405*# National Aeronautics and Space Administration, Washington, D.C.
JAPAN AND THE ENERGY CRISIS
Yu. K. Semeyev Sep. 1974 15 p refs Transl. into ENGLISH from Prob. Dalnego Vostoka (Moscow), no. 2, 1974 p 108-111
(NASA-TT-F-15924) Avail: NTIS HC $4.00 CSCL 10A

The energy crisis in Japan is discussed in terms of market reliance on petroleum imports. Retrospective treatment is given the energy situation as it has existed in the economic milieu since the second World War. The requirements, possibilities, and difficulties of dependence on Middle East oil are identified, along with the economic consequences of rising prices of petroleum products. A.A.D.

N74-32406# Illinois Univ., Urbana. Dept. of Computer Science.
[RESEARCH PROGRESS IN CIRCUITS, HARDWARE AND SOFTWARE SYSTEMS, MACHINE PRECEPTION, AND COMPUTER LANGUAGES] Quarterly Technical Progress Report, Jul. - Sep. 1973
1973 135 p refs
(COO-1469-236; UIUCDCS-QPR-73-3) Avail: NTIS HC $8.75

Summaries are given for the following research topics: (1) circuits, (2) hardware systems, (3) software systems, (4) switching theory and logical design, (5) machine and software organization studies, (6) computer systems analysis, (7) aspects of combinatorial computing, (8) theory of digital computer arithmetic, (9) automation of introductory computer science courses, (10) center for advanced computation report summary, (11) machine perception and intelligence, (12) statistics, (13) computer languages for mathematical and numerical analysis, and (14) general department information. NSA

N74-32407# MB Associates, San Ramon, Calif.
AIRDROP CONTROLLED EXIT (ACE) SYSTEMS Final Report
G. L. Fritzler Jul. 1973 144 p refs
(Contract DAAG17-72-C-0192; DA Proj. 1F1-62203-AA-33) (AD-780013; USA-NLABS-TR-74-38-AD) Avail: NTIS CSCL 15/7

A study was conducted to identify and compare techniques which minimize ground dispersion of either air dropped troops or platform loads caused by the time increment between sequential exit from the aircraft. Twenty (20) concepts for platform loads and seven (7) concepts for personnel airdrop were determined to have sufficient merit for consideration as operational airdrop systems. Each of these systems reduce drop zone dispersion from that achieved with the presently operational systems. Some of the concepts, however, are diminished in value from a systems standpoint in that attainment of shorter drop zones is accomplished only by introducing some operationally undesirable system characteristic. A comparative evaluation is performed by a scheme that produces figures of merit whereby concepts for either type of airdrop may be compared among themselves and with the currently operational systems. Author (GRA)

N74-31484 Ministry of Defence, London (England).
ESTIMATION OF PROGRAMMES AND COSTS FOR MILITARY AIRCRAFT
J. C. Morrall *In* AGARD Aircraft Design Integration and Optimization, Vol. 1 Jun. 1974 14 p (For availability see N74-31458 21-02)